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EDITORIAL NOTES.

Refuse Destructors and Electric Power Plants.

In September of last year we referred in these columns to some interesting practical results obtained from the operation of a somewhat extensive destructor installation by the municipality of Bradford, Yorkshire, England. Mr. McTaggart, who had charge of that plant, emphatically stated it as his opinion, based upon lengthy practical experience, that from an electric lighting point of view there was not much to commend the idea of combination with refuse destroyers. To dispose of the city's refuse incineration is the ideal method, whether considered from a sanitary or economic standpoint, but the value of the heat for raising steam for driving electric generators is a matter of but secondary import. This view is becoming recognized as the correct one by authorities and engineers, and in consequence there is not so much heard nowadays of wonderful results in the way of economical generation of electricity from the rubbish heap. Many combined plants are, however, being laid down, especially in England, but in most cases the idea is to first get rid of the refuse, and then to utilize whatever advantage, if any, there may prove to be in the direction of heat for steam raising. The opinion of Mr. McTaggart is to a great extent confirmed by the views which have just been stated by Mr. J. S. Highfield, the city electrical engineer of St. Helens, before the Municipal Electrical Association at Glasgow, but it must be borne in mind that at St. Helens the destructor is doing service in combination with an electric lighting and traction system, which is not the case at Bradford. Mr. Highfield remarks that it is not in any way desirable to operate the destructor to follow, for instance, the variations of a lighting load. If a lighting load only is to be worked, and the day load is small, the use of a destructor is limited to the working of only a small part of the load. In the case of a direct current plant, a large storage battery is a most useful adjunct in this respect as in others; it enables the plant load factor, and hence the utilization of the steam, to be greatly improved. Where a lighting station only is to be supplied, the correct way to design the destructor, is with a boiler considerably too large for the destructor to steam alone to its full capacity; when the heavy load comes on, coal may be burnt in the second furnace to drive the boiler to its full capacity. Mr. Highfield regards such an arrangement as only suitable for small installations. He thinks, however, that if the steam is used in connection with a traction station, or a station which supplies energy for both lighting and traction, then the destructor steam can be put to very much better use.

In regard to the plant employed at St. Helens, this consists of two furnaces, each divided into two cells, each furnace serving to steam to its full capacity, a boiler with 1,470 square feet of heating surface. The forced draught is provided by an 18 hp. motor driven fan, the average pressure in the closed ash-pits being three inches on a water gauge. The plant at the power station consists of five steam generators of a total output of 1,000 kw. In addition to the steam from the destructor boilers, steam is supplied from a battery of four, 30 feet by 8 feet, Lancashire boilers. The steam ranges are designed so that two steam sets, each of 125 kw. capacity, can be run from the destructor independently of the other boilers, or the destructor boilers and Lancashire boilers can supply the whole range in parallel; in each machine circuit, a watt hour recording meter is fixed to meter the output from the generator. The usual practice is to drive one or both of the 125 kw. sets from the destructors only for a part of the day, and later on, when more plant is required, to parallel both sets of boilers on the whole load.

The installation was only opened about a year ago so that the working during the past twelve months has been somewhat interfered with, a considerable amount of altering and reconstructing being done, thus preventing the fullest efficiency of working being obtained. Mr. Highfield produced figures of the year's working, which he said gave a fair idea of the actual value of a small destructor plant in a town where the refuse has a good calorific value. From those figures it appeared that the net saving to the destructor department, due to combining the electric works and the destructor works, is $2,250, less $250 on boiler repairs, and less the interest and sinking fund charges on $7,500 (which represents the extra capital cost on the boiler plant above what would have been necessary for smaller boiler plant for working the mortar mills, the blowing fan and other plant on the works), which may be taken as $450, leaving $1,350 or 41 per cent. of the total wage bill. The cost of cremating the refuse and removing the clinker is therefore reduced from 63 cents per ton to 48 cents per ton.

In addition to supplying steam to the electric works the St. Helens destructor also supplies steam to drive two mortar mills and a steam winch. Mr. Highfield concluded as follows: "In cases where a suitable site for destructor and electric works exists, and where the works are not very large, the combination can be usefully made, when a traction or other good all-day load exists. For a very large works, or for a station which only drives a lighting load, there are not many instances where there is any economical value in the combination. Without desiring to generalize, the writer thinks that in these cases it is better to use the destructor furnaces to provide steam for driving mortar mills or other machinery, on which the calls are not so exacting as on an electric power plant."

As regards the figures given above it should be borne in mind that the refuse in this country contains more moisture than that in England, and consequently would require more heat to consume it.

* * *

Municipal Lighting.

The city of Chicago is apparently trying to impress upon other great centers of population the many alleged financial advantages to be derived from municipal ownership. About a dozen years ago the Chicago city fathers decided to start in the street lighting business and become independent of private lighting companies. This was done, and as a result the City Electrician, in a recent issue of a Chicago daily, explains to the trustful residents of the Windy City how carefully and judiciously their money is expended and incidentally how well their streets are lighted. He says:

"After an experience of thirteen years in owning and operating a municipal lighting plant for street lighting purposes it is proper that the city should furnish to the citizens some definite statement as to the results obtained and benefits derived by the city from the service which it has been furnished under varying conditions, and that a comparison be made between the results obtained and those that might have been secured by renting from private corporations the service which it has elected to furnish under municipal ownership. The length of time the service has been in operation is sufficient to give a practical test of municipal ownership of street lighting systems, and this length of time should settle once for all the perplexing problem of depreciation."

After stating in detail the amount of money that has been paid out, and what the city owns, the writer continues as follows:

"For instance, during the year 1900 the city operated an average of 3,867 arc lamps at a total cost of $265,129, which includes an $18,750 interest charge, and over $10,000 on account of depreciation, while to have rented these lights at the lowest price quoted to the city would have cost $458,021, leaving a total net saving of $192,891 for the year 1900. There is no reason why an equally good or better record will not be made in 1901."

Sixty-eight dollars per light per year would certainly seem an excellent showing if, unfortunately, as a contemporary aptly pointed out some time ago, city officers and commercial electric light companies were not in the habit of making their calculations and estimates on different basis.

The writer states that $10,000 has been set aside for depreciation, but as the city's machinery and apparatus cost in the neighborhood of $1,000,000, were $50,000 set aside for this purpose it would by no means be too much. It should also be borne in mind that the city receives no return in the way of taxes from the real estate, which it is obliged to own, and which would probably amount to over $10,000 annually. Under these circumstances and others, which for lack of space, we cannot go into, there is little wonder that municipal electric lighting plants "appear" to pay well.

* * *

Albert L. Johnson.

The death of Albert L. Johnson, which occurred on the night of July 3, came as a surprise to many of his friends. Mr. Johnson had been ill for several months, but had only been confined to his room for the last three weeks. His death was due primarily to heart failure.

Mr. Johnson was little more than forty years old, but he had a remarkable career, as will be seen by his biography on another page of this issue. He began at the bottom of the ladder in the electrical railway business. Twenty-five years ago he worked for $2 a week. He left a fortune, it is said, that will exceed $3,000,000.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

The index for the twentieth volume of Electricity goes with this issue.

◆

Mr. Charles A. Coffin, president of the General Electric Company, has just returned from Europe.

◆

You pushers in the electrical field should reflect over the untimely death of Al. Johnson. Go slowly.

◆

Mr. Burt G. Hubbell is moving along at a lively rate in the telephone business. Our news columns show that he is interested in several large enterprises.

◆

We chronicled the fact last week in our financial column that Judge Thomas had accepted the presidency of the Telephone, Telegraph and Cable Company, and we are glad to see that the Judge accepted the position with the distinct agreement "that it would be a fight to the finish and that the company would not combine with or sell out to its competitor."

◆

The following gentlemen comprise the Visiting Committee of the National Bureau of Standards: Prof. Elihu Thomson, Lynn, Mass.; Prof. E. L. Nichols, Ithaca, N. Y.; Prof. Ira Remsen, Baltimore, Md.; Dr. Henry S. Pritchett, Boston, Mass., and Mr. Albert Ladd Colby, South Bethlehem, Pa.

◆

A cable dispatch says that S. North, a Paris scientist, has taken out a patent for an invention which he claims will supplant petroleum as a motive power and make stopping to take on a supply of electricity unnecessary for automobiles. It is an automatic generator of electricity that takes up very little space and makes electricity as the automobile speeds on its way. The small quantity of water required for generating the electricity can be carried in a bottle. The French Government has under consideration the advisability of using this new invention in connection with its submarine boats.

◆

At least four, probably more, electric elevators are being put into the house that Andrew Carnegie is building on Fifth avenue, between 90th and 91st streets, New York. They are operated by electric buttons and can be handled by a small boy. Automatic devices secure the safety of both the occupants and the operator.

◆

A report from Washington, D. C., states that, despite many handicaps, the electric hotel 'bus placed at the disposal of the Emergency Hospital anthorities without cost by the Washington Electric Vehicle Company, is proving so satisfactory that it is probable efforts will be made to secure an electric ambulance for regular service at the hospital.

◆

According to a dispatch from Toronto, Ont., dated July 4, the Marconi system was used in the operation of wireless telegraphy between points three hundred miles apart, and its success will confirm the Dominion Government in its proposed extension of the wireless system along the coasts.

◆

A unique arrangement for holding the nickels and dimes of the street car conductors has recently been introduced on several of the Traction Company's lines in Philadelphia, Pa. The holder consists of an ordinary leather belt, to the front of which is attached a number of small tubes, looking somewhat like dime savings banks. These little tubes are so arranged that the coin is put in at the top and taken from the bottom, where it is held by a spring attachment. The tubes are four in number, each holding a different denomination of coin. When the fare is collected the coin is dropped in at the upper part of the tube, when change is wanted the conductor can quickly obtain whatever coin he wishes. The coin belts, it is expected, will before long be adopted on all the lines.

◆

The Columbus Manufacturing Company's new 25,000-spindle cotton mill was formerly started July 4, with elaborate ceremonies. This mill is the first in Georgia to be operated exclusively by electricity. Its power is obtained from the falls of the Chattahoochee River. The mill is to manufacture brown sheetings for the trade of the Far East.

◆

The local manager of the Pacific Postal Telegraph Company at Seattle, Wash., announces that telegraphic communication is now open from that city to Port Simpson, Alaska. The completion of the line to that point marks a stage in the great scheme which has been underway for years—to carry telegraph lines by way of Fort Cudahy and Eagle City down the entire length of the Yukon River to its mouth. The route to Fort Simpson is via Vancouver and Ashcroft, thence by the old Government line to Quesnelle, thence to a point on the Skeena River and then down the river to Port Simpson. Commencing at Dawson and going in a southerly direction work on the line is also being prosecuted. This has been so far accomplished that there remains now only a gap of about eighty miles in the direct connection from Vancouver with Dawson. This gap exists between Hazleton and Telegraph Creek. There has been telegraph connection all winter between Skagway and Telegraph Creek. This summer the work of completing this gap is being pushed with vigor and it is now predicted that with the advent of winter telegraphic communication with Dawson from Vancouver will be an established fact.

◆

Alfred C. Bostwick, the Boston automobilist, broke the record for one mile on his 40 horse power machine July 5 at Elkwood Park, Long Branch, N. J. The record performance was in the second mile of an exhibition spurt, of three miles, which he covered in 3:52¼ He made the first mile in 1:18¾, the second in 1:16¾ and the third in 1:17.

◆

The Cunard Line Steamship Lucania, Capt. McKay, from New York June 29 for Liverpool, by way of Queenstown, communicated with the Marconi station at Brow Head from sixty-five miles westward at that point at 2:20 P. M. July 5. The agent of the Cunard Line at Queenstown later on received another wireless message from the Lucania, saying she was fifty miles west of Fastnet at 3:20 P. M., and proceeding at half speed, owing to fog.

◆

We are in receipt of the fourth of July souvenir sent out by the American Electrical Works of Providence, R. I. This remembrance for Independence Day shows Independence Hall in Philadelphia, the Liberty Bell and the table on which the Declaration of Independence was signed. On the cover the Liberty Bell again appears in color with the following lines beneath it: "Ye Liberty Bell. 'Proclaim Liberty throughout the Land unto all the inhabitants thereof.'" On the second page in a wreath the following appears: Compliments of American Electrical Works. Bare and Insulated Wires. Providence, R. I.

◆

The Manhattan Railway Company's new electric power house, in this city between 74th street and 75th street and East River, is nearing completion, and the machinery is now being put in.

◆

A sheep raiser in Guadaloupe County, N. M., is shearing his sheep with power furnished by electricity. He has established a camp on the Rock Island extension two miles from Juan Pais and is there shearing 25,000 sheep. The machine secures about three quarters of a pound more wool from each sheep than did the old hand method. One man can shear 200 sheep a day.

◆

From Switzerland we hear of some particularly interesting experiments which a Swiss professor has been making on the question of the extent of injury which would result to a passenger on an electric tramway from coming into contact with the overhead trolley wire, says the London "Electrical Engineer." The soles of the boots prove an effective obstruction to the passing of the current to earth, and, according to the report, currents up to 800 volts had no effect upon the experimenter, even when grasping the wire tightly. When, however, the current came to 2,000 volts, the skin of the hand tended to burn when the wire was only lightly touched. These results were obtained when standing on moist gravel, but when the professor stood on clay covered with moist coal-dust, the effect of touching the wire is said to have been unbearable at a voltage of 1,000. The experimenter's conclusion, therefore, is that the voltage of overhead trolley wires should in no case exceed 1,000. The tests described above, however, do not meet the case of a passenger coming into contact with the wire while he holds a conducting medium, as, for instance, a brass rail, and accordingly the experiments were extended to ascertain the effect under such conditions, especially the effect on a workman who, with wet hands, might catch hold of two wires—one in each hand. The results obtained under these conditions were that at 10 volts a slight trembling was experienced in the finger muscles, while at 40 volts the whole arm was paralyzed. With the hands dry the effects were not so serious, the dangerous voltage being put at 90. But, it is said, the difference between 80 and 90 volts was very pronounced. The experimenter estimates that while there is great danger from touching a trolley wire under these circumstances at 100 volts, death would result with a current of 240 volts.

◆

An electrical transmission scheme for utilizing the falls on the Glomen at Askin, in Norway, which has been under construction 18 months, is expected to be completed next year. The plant is designed for about 45,000 hp. At present three Francis turbines coupled to three-phase 2,000 kw. 8,000 volt dynamos are being installed. The pressure will be raised to 20,000 volts for transmission to Christiania. The work is being carried out by the Schuckert Company.

◆

At frequent intervals the daily press announces that some one has discovered a process for tempering copper, which on investigation usually turns out to be of no commercial use. The latest is that a youth residing at Hallstead, Pa., has accidentally discovered such a process. The article states that how it was done or what the modus operandi is will not be told until such steps have been taken as will insure to the youth the benefits of his discovery.

◆

The yacht Virginia, owned by Isaac Stern, used its searchlight on the evening of July 7 to locate a man who had fallen overboard from an excursion boat on the Hudson River. He had discarded his coat and vest and was swimming toward shore when the yacht picked him up almost exhausted and landed him at Irvington, N. Y.

◆

The elevated track of the military road from Berlin to Zossen, it is stated, will be the scene of the experiments which are to be carried out in August in connection with the projected electric railways in Germany. The proposal is to obtain a speed of 125 miles an hour on these lines, says a London contemporary. The elevated track in question has been especially strengthened to permit of the tests being made, and although it may be found that such a high speed as suggested is not feasible, the experiments will no doubt prove of the highest importance for the improvement of rapid transit. Two cars will be employed, the construction and equipment of the one differing from the other in order to allow of manifold experiments being made. Each car will have four motors, aggregating from 1,100 hp. to 3,000 hp., two three-axle movable trucks, and the necessary transmitters, switching apparatus, etc. The cars will be 71¼ feet long, weigh about 90 tons, and carry some 40 or 50 passengers.

◆

The activity of inventors with regard to producing white lead by electrolysis is attended by several recent important patents for improvements along this line. A patent issued to Edwin D. Chaplin, of Winchester, Mass.. and Henry G. Holloran, of Boston, consists in adding to the sodium nitrate solution in the anode compartment of a partitioned cell, a certain amount of sodium chloride, lead anodes being used. The lead nitrate, which is formed upon passage of the current, is at once transformed to chloride, which is kept in solution by heating the electrolyte. Continued action of this current oxidizes this chloride of lead to chlorate and from this hot solution white lead is precipitated by means of an alkaline carbonate, obtained by injecting carbonic acid into the cathode solution. Further rapid advancement may cause the electrolytic processes to supersede all others.

◆

Advices from France state that an engineer in that country by the name of Malche claims to have solved the problem of telephoning by submarine cables to great distances. He has been carrying out some exhaustive experiments on the point, and it is stated that at Calais recently M. Malche succeeded in transmitting a telephonic message with perfect distinctness through a cable 400 miles long.

◆

Marconi has a motor carriage which is equipped with a folding cylinder on top of the car and devices for the transmission of wireless telegraphic signaling. Motor cars fitted with this device are to be used in the forthcoming military manœuvres in Europe. All British battleships and cruisers in commission for home stations, and all vessels being prepared for the reserve, training and Channel squadrons are to be fitted with wireless telegraphy apparatus. All future battleships and cruisers sent to the Mediterranean are also to be so equipped.

◆

The want of direct telegraphic communication between Genoa and Milan in Italy, on the one hand, and London on the other, says an English contemporary, has been felt for some considerable time, but although the question had been on the tapis for the past three or four years nothing definite was done. As the result of repeated representations from the British General Post Office, the Italian Administration are now moving in the matter, a proposal having been put before the Italian Parliament to establish two wires from Genoa and Milan respectively to the French border, by means of which telegraphic communication between Genoa and London and Milan and London could be maintained.

◆

The Stilwell-Bierce and Smith-Valle Company of Dayton, O., recently shipped to the street railway company of Asheville, N. C., a 27 inch improved cylinder gate Victor turbine water wheel on a horizontal shaft in a wrought iron flume. The wheel was made entirely of bronze and under 60 feet working head of water, will develop 750 hp.

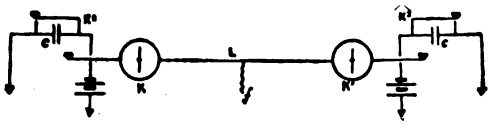
AN IMPROVED METHOD OF APPLYING THE INSULATION OVERLAP TEST.*

BY WALTER BETTS.

The old familiar insulation overlap method of localizing a fault in a single cable appears to have been discarded chiefly on account of the difficulty in obtaining reliable results, owing to the variation of the resistance of the fault during the interval between the inter-dependent tests at the two ends. This defect was aggravated to a great extent by the manner of proceeding generally adopted.

The employment of the Wheatstone bridge seems to have been universal, and the arrangements invariably made for obtaining the two sets of inter-dependent observations were also defective—the common practice being for one testing station to take a series of tests from which the apparent best were selected or an indiscriminate average was made, to be calculated in combination with another average similarly established at the co-operating station. It is obvious that such observations can have only a chance and uncertain connection with each other, especially when the delay, disturbance and difficulty experienced each time in balancing to a greatly and rapidly varying fault-resistance, or a changing earth-current are taken into consideration.

Alternate single measurement is a step in advance, but little or no substantial advantage is gained so long as the delay and disturbance on the cable, caused by discharging, recharging and rebalancing after each test, are not eliminated, and so long as the system of striking a mean of such readings is followed.



INSULATION OVERLAP TEST.

It is clear that only one pair of readings—composed of a single reading taken at each end—can bear any near or certain relation to each other, therefore no others can have a connective value in the calculations; in fact, they only depreciate those which are distinctly correlative.

By adopting the substitution method of measurement, and arranging so that the first observer shall take a reading at a given moment, then leave his end of the cable insulated, instead of allowing it to earth and discharge, so that the second observer shall be able to obtain a reading almost immediately afterwards, most of the above-mentioned objections disappear and the remainder are minimized.

Let K press down his key at a suitable time and note the deflection at a prearranged moment (clocks being previously synchronized to a second or less), then instantly release his key. At the latter moment K^1 will apply his current and take a reading as quickly as possible. The two results thus obtained form a distinct calculable pair, or set, and similar pairs can be repeated as often as desirable.

With synchronous timing the small condenser C is not strictly necessary, but by causing a slight impulse on the respective galvanometers it has the advantage of enabling the operators at each station to see when the other applies or discontinues his current. The advantages of this method are:

No equilibrium has to be obtained—often a very troublesome matter.

The instantaneous insulating by K, after his test, enables K^1 to obtain a reading without loss of time.

The galvanometer unsteadiness, fault disturbance and necessity of recharging the cable—as caused by earthing instead of insulating—after each test being avoided, the complementary observation can be made with much greater rapidity and certainty.

The residue of K's current in *a* and *b* being free to escape only by way of the fault, tends to keep the latter constant (without further polarizing it, owing to the momentary fall of potential on the disconnection of K's battery) until the current of K^1 comes into effect.

It is assumed that the fault would be approximately centralized by inserting resistance at the shorter end of the cable, and that due precautions with regard to the presence of earth current and reading to cable zero would be observed. For this purpose it would be convenient to connect by means of a key the terminals of the condensers, C (K^2).

* * *

TRADES TRAINING FOR NON-TECHNICALLY EDUCATED MEN.*

BY PROF. B. V. SWENSON,

Assistant Professor of Electrical Engineering, University of Wisconsin.

The State University is under obligations to the commonwealth which are not felt by educational institutions of independent endowment; created by the State, supported by the people of the State, its advantages and influences should be made as far-reaching as possible.

As an example of the dissemination of trades knowledge among the people of the State, may be cited the work now being carried on in agriculture and its allied industries. For a number of years short courses in agriculture, animal husbandry, dairying, etc., have been given to practically all those who have had the ambition to acquire such knowledge. During the past fifteen years there has been an ever increasing demand from those engaged in other industrial pursuits, for trades training applicable to their special needs. To meet this demand there has been established at the University of Wisconsin a school for apprentices and artisans, which opens July 1, the first session to continue six weeks. The plan of this school, which originated with Dean J. B. Johnson, has been worked out and will be carried on under the direction of the College of Engineering.

That there is a great need for training of this character is clearly shown by the large enrollment of the correspondence schools. These schools have exerted a powerful influence in assisting men to study along their own and other lines of work.

The school of apprentices and artisans, while bearing in its courses of study some relation to those of the correspondence schools, is not in opposition, but should rather be considered as supplementary to the latter. From the nature of their instruction the correspondence schools cannot give shop or laboratory practice, but persons attending the school for apprentices and artisans, and having a fair knowledge of the theory of certain lines of practice, may spend their entire time in the shops or laboratories if they choose, and so put into practice or prove experimentally the scientific principles learned from books or from the correspondence school. Another great advantage of the new school is that of personal instruction, under which system many points can be brought up in discussion which would not appear in written correspondence.

As an illustration, the central station man, who, by means of correspondence instruction, or otherwise, has become familiar with methods of testing, could here perform the experiments relating to them and become proficient in the use of the necessary instruments. If he has not had the preliminary instruction he can obtain both this and the instrumental practice during his course, and he would also have the opportunity of devoting a portion of his time to other subjects likely to be of value to him, such as mechanical drawing, transmission of power, or experimental work relating to engines and boilers.

The School of Apprentices and Artisans has been established for the benefit of machinists, carpenters, sheet metal workers and electricians; stationary, marine and locomotive engine men; shop foremen and superintendents; superintendents of water works, electric light and gas plants, power stations, factories and large office and store buildings; for business men interested in technical affairs and for young men who wish to qualify themselves for such positions. For these employments the full four years' professional course in engineering are not required, and yet to satisfy the present demand on this class of men it is necessary for them to obtain a certain amount of technical knowledge. In the case of apprentices the purpose of the school is to give them a theoretical and practical instruction in the line of their trade, which they would not get in the shops, but it is not the purpose of the school to give the shop practice which they are expected to receive in serving their apprenticeship.

The machine trades lie at the basis of all manufacturing, and superiority in these very largely sustains our modern prosperity. The practical abandonment of the apprenticeship system also, as the result of the very general adoption of labor-saving machinery, and the common practice of confining a workman to the operation of a single type of machine, leaves our young men with no means of acquiring that wide and thorough knowledge of the machinists's trade which formerly they could obtain in the workshops by a long apprenticeship. For these reasons some new kind of industrial education becomes imperative. Some examples may serve to illustrate the advantages to be derived in special cases.

A person may be employed in connection with, or have an interest in a manufacturing business, without having had training or experience in mechanical matters. He would be able to obtain an insight into the general principles and operation of machinery, engines, boilers and electrical or other apparatus.

A man in charge of or employed in an electric plant would have an opportunity to become familiar with the use of electrical measuring instruments and with methods of electrical testing. He would also have opportunities for experimental practice with the indicator, calorimeter, and other instruments used in the testing of engines and boilers; such knowledge would enable him to operate his plant more efficiently, and therefore more economically.

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*From the "Electrical Review," London.

* Paper read at the Northwestern Electrical Association Convention, held at Sheboygan, Wis., June 26-28, 1901.

An expert machinist may desire a knowledge of mechanical drawing in order to fit himself as a designer. His needs would be met by the courses which have been provided in mechanical drawing. These few illustrations serve to show the scope of this new school.

The following departments of work are provided for in the current session:

1. Course in steam engineering. 2. Course in applied electricity. 3. Machine design. 4. Materials of construction and mechanical transmission of power. 5. Shop work.

COAL AND ASH CONVEYING GEAR.*

BY R. A. CHATTOCK,
City Electrical Engineer, Bradford.

The question of dealing with coal used in electric generating stations is one of the most important that presents itself to the electrical engineer and of almost as much importance is the question of disposing of the ashes that are produced by the boilers. Taking the average of a number of works the cost of the coal works out at .71d. per unit, and this represents 46.6 per cent. of the average works cost per unit. In a station producing 5,000,000 units per annum this means an expenditure of £14,791 per annum, or at an average rate of 12s. per ton, a consumption of 24,652 tons per annum. The cost of conveying and handling this coal varies between very wide limits, according to the distance it has to be taken, the height to which it has to be raised, and the means at disposal. As a rule coal contracts are drawn up to include the cost of cartage into the generating station, and it is consequently somewhat difficult to give an exact figure for this item. A charge of 6d. per ton for cartage from an ordinary railway siding for a distance of half a mile is however a fair estimate. This represents an annual cost of about £616 on the above quantity of coal.

If it is possible to put in a conveying apparatus that will take the coal direct from a railway or water siding and deliver it to the generating station, and if the annual charge on this, represented by say 10 per cent. on the prime cost of the apparatus, does not exceed the above amount, it is certainly worth while to adopt this principle. If, however, the distance is great between the siding and the station, and cost of the apparatus excessive, it is better to have the coal carted to the generating station and distributed in the coal bunkers by means of a local conveying apparatus.

Horse traction for cottage purposes is a very unreliable means, especially in winter time when the frost is on the ground and when it is very important that there should be no interference with deliveries, and on this account, and also that the cartage may be under the direct control of the station engineer, a more reliable means should be provided. This may be effected by means of motor driven-trolleys, each capable of holding about five tons, so constructed that they can be backed under the coal drops of a railway siding or under the cranes used to unload a barge, and arranged so that they can be tipped into convenient hoppers in the generating station. Such vehicles can travel at a speed of eight miles an hour, and when not used for coaling purposes can be utilized for conveying cable drums or other heavy gear about the town. They should be preferably steam-driven, and can be purchased for £500 or £600 each.

Once the coal has reached the station the question of the most convenient means of storage presents itself to the engineer. The minimum amount which should be stored in a station is a 100 tons for every 1,000 ihp. installed, and this amount can be conveniently contained in overhead bunkers placed above the boilers. It is, however, desirable to store four or five times this amout if possible, and to effect this an auxiliary coal store is necessary. This must obviously be placed outside the boiler house. It should be near the ground level and connected to the overhead store by means of conveying and elevating machinery.

The coal store or bunkers, whether overhead or on the ground level, may be constructed of brick or iron work. The flooring should be sloped at an angle of 45 degrees to points in the center, from which distributing shoots can be taken either to supply the boilers or the conveying apparatus. The maximum depth of the coal stored in such bunkers should not exceed 10 feet. If this is exceeded the coal is liable to become overheated and to catch fire.

The construction of the bunkers, including the roof-work, should be entirely of non-combustible material, and fire hydrants should be placed in accessible positions. In an auxiliary coal store it is usual to have a conveyor running over the top of the store and returning underneath it. By means of this the coal can be collected from the points where it is discharged from the carts and can be distributed in the store. If it is desired to draw coal from this store the return half of the conveyor, which runs beneath it, can then be fed by shoots, and arranged so that it will deliver to an elevating apparatus. The elevating apparatus should take the coal to the level of the coal bunkers over the boilers, and it should be possible to feed this either from the auxiliary coal store or direct from the carts. After the coal has been elevated to the desired height it can then be distributed in the overhead bunkers by means of another conveying apparatus, and from these bunkers it should be fed to the boilers through shoots, which should be fitted with controlling valves.

There are many forms of conveying apparatus and I will endeavor to describe those most in use, and point out their advantages and defects.

The worm type of conveyor consists of a worm or screw which revolves in a semi-circular trough. The coal is fed into one end of this trough and is gradually pushed along by means of the worm; it is allowed to fall through doors in the bottom of the trough, which can be opened when necessary. This apparatus can only deal with small coal, and it is very liable to get out of order owing to to lumps of coal becoming jammed between the worm and the trough. The power taken by this apparatus is also excessive owing to the friction between the worm and the coal, and between the coal and the sides of the trough.

The chain type of conveyor consists of a chain formed of lines of bar-iron riveted together; this is dragged along a flat-bottomed trough having doors on the underside; the chain passes over a sprocket wheel which is driven by gearing, and is dragged along the trough pulling the coal with it. This conveyor is less liable to get out of order than the worm conveyor, but the friction between the chain and the trough and the coal and the trough is excessive. Another objection that this conveyor has is the fact that the rivets in the chain, which form the pins on which the links turn, are buried in the coal, and in time these and the holes in the links become worn and cut away; the centers of the links consequently become elongated and the chain does not gear properly with the sprocket wheel. The life of such a chain is not more than from three to four years.

The push-plate type of conveyor was devised with the idea of keeping the chain itself out of the coal. The chain of this conveyor runs on rollers above the trough, and attached to it are a series of rectangular plates which dip down into the trough and push the coal along as the chain is dragged forward. This is a better form of conveyor than the last, but it has the same objection owing to the excessive power absorbed in the friction of the coal when being dragged along the trough.

The band type of conveyor consists of a broad endless india-rubber or fiber belt, from 18 inches to 24 inches in width, running over pulleys at either end, and supported by rollers throughout its length. These rollers are shaped or inclined so as to cause the belt to sag in the center and so prevent the coal from falling off. In order to discharge the coal from the belt the latter can be tipped on one side at any desired point, and the coal will fall off the other side, or the coal may be scraped off by an inclined scraper placed at any point. This form of conveyor takes less power to drive, and there is no power absorbed in friction as described in the previous types. This type of conveyor has the advantage of being about the cheapest in first cost, and rubber belts such as these have been known to last from ten to twelve years, and even then to be in a very fair condition. The working parts of the apparatus can be lubricated, preferably by means of grease.

The steel trough conveyor is composed of a number of steel plates, which are usually turned up at the edges, and which are fixed to the links of an endless chain. The chain may be run on rollers or may be fitted with small flanged wheels, which run on a tramway. The plates are so arranged that when the chain is approximately in a straight line they form a continuous trough, which travels along. The coal, which may be of any size, is fed on to this trough and carried along by it to any desired point, where it can be discharged. It has the advantage that the working parts of the chain are kept away from the coal dust, and there is no power absorbed in friction, the coal being carried along bodily. The conveyor is not, however, adapted for the convenient discharge of the coal at any point along its route. The return chain also is useless.

All the above types of conveyors can only be used for conveying coal approximately horizontally, and if used for elevating they should not be run at a greater angle than 30 degrees with the horizontal.

Another type of conveyor that is being extensively adopted now is one in which the coal is conveyed by buckets which are hung on an endless chain. These buckets always hang vertically, and in this way the conveyor can be used either for conveying horizontally or elevating vertically, or at any desired angle. The chain itself is fitted with small flanged wheels, which run on an ordinary tramway composed of T section rails. Where it is necessary to change the direction of the motion from conveying horizontally to elevating vertically, curved rails are fitted to effect this. The chain is a double link chain on each side of the buckets, and the driving is effected by means of toothed wheels or pawls, which engage with distance blocks fixed between the double links. This conveyor can only run in a straight line when moving horizontally, but the direction of the motion may be changed to one at right angles if desired, where the chain is ascending or descending vertically, by allowing the chain to twist where it is hanging free. The buckets are filled by means of funnel shaped spouts which fit into them as they pass along, and each spout allows just sufficient coal to enter in order to fill the bucket. This conveyor takes very little power to drive it, as there is only the friction in the wheels to overcome and the dead weight of the coal to be raised. It is so free that the weight of the coal in the ascending buckets is enough to cause the chain to run backwards if the driving power is taken off, and means have to be taken to prevent this by using a ratchet and pawl. The working parts are protected from contact with the coal or ash dust, and in consequence have a maximum life. The buckets can be tipped at any desired point by means of a lever engaging with a pin on the side of the bucket. This conveyor can be used both for coal and ashes if it is arranged to travel over the coal bunkers and under the ash pits of the boilers, and in this way the cost of installing two conveyors and special elevating gear is obviated.

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*Paper read at the Municipal Electrical Association Convention, Glasgow, June 19-21, 1901.

Another type of conveyor and elevator that may be employed is as follows:—

A long girder of H section is supported at any desired height by means of lattice framework and tie rods. On this is fitted a trolley which can be pulled backwards and forwards by a wire rope; on this rope is a pulley with a hook attached, and at certain points this hook can be lowered to the ground level, where a skip, holding about a ton of coal, can be attached to it. The skip is then raised, and when the hook is brought to the level of the girder it is gripped by the trolley, and the whole is traveled along; the skip can then be tipped at any desired point. The motion is then reversed, the skip brought back again, lowered, unhooked, and a fresh skip attached. In this method it is necessary to fill the skips by hand; they can, however, be emptied at any desired point. The working parts are kept free from coal and ash dust, and the apparatus does not take an excessive amount of power to drive.

Turning now to elevators as distinct from conveyors. The most usual type adopted is that having an endless chain, which passes over pulleys at the higher and lower level, and has buckets fixed to it. These buckets dig into the coal at the bottom end, in what is called the boot of the elevator; they carry the coal to the top, and as they turn over the top pulley they discharge the coal down a shoot, which, as a rule, feeds on to a conveyor. This form of elevator takes a considerable amount of power to drive it, and it has the disadvantage that the working parts of the chain come into contact with the coal or ash dust, and in consequence wear takes place.

For unloading coal from a barge the best form of elevator is an automatic grab which can be attached to a crane. This, while open, can be dropped into the coal, and as soon as the lifting chain begins to pull, the grab closes, digs into the coal and fills itself. It can then be lifted to any desired height and discharged into a hopper, from which the coal can be taken by the conveyor. If desired each grab can be weighed, and an automatic register kept of the weight.

Conveying and elevating apparatus is peculiarly liable to breakdown, owing to the rough nature of the work it has to do, and in order to guard against the serious results which a breakdown may entail during the heavy winter loads, some duplicate means should be provided for getting coal into the station and for getting the ashes away from it. Owing to the high initial cost of a good conveying plant it is not advisable to install this in duplicate unless the station be very large and the outlay be warranted. It would appear best to use some simple and effective means, such as a system of light tipping trucks which can be run on a tramway in the boiler house and which can be filled by hand. Such an arrangement of course entails a considerable amount of labor, but being only a stand-by, and to be used only in an emergency, this item cannot amount to very much. In some cases means may be provided for taking the coal carts themselves into the boiler house and dumping the coal on to the floor.

With reference to ash conveying, the same type of apparatus can be used as is employed for coal conveying.

The ashes should not be allowed to interfere with the handling of the coal in any way, and should, if possible, be dealt with in a cellar below the boiler house flooring. In a boiler house containing a large number of boilers, if the ashes are allowed to accumulate, even for a couple of days, the whole place becomes so choked that it is impossible to work the boilers properly, and if there is a large space available below the floor the ashes can be allowed to accumulate here for several days if it is impossible to get rid of them. The ashes should be taken to an overhead bunker, preferably at the end of the boiler house furthest from that at which the coal enters, and from this bunker they may be fed into carts or trucks by means of shoots. It is most essential that they should not be allowed to accumulate, and it is quite as important to provide duplicate means for getting rid of them as it is for getting the coal into the station.

INCANDESCENT LAMP ECONOMY.*

BY GUY V. WILLIAMS.

Operating an electric light plant is an industry which permits of no relaxation of vigilance and progressiveness on the part of the management if it is desired to keep abreast of the times and to get the best returns on the investment. So rapidly is progress made that even a modern station must constantly adopt new methods and ofttimes new machinery. Consequently it is not surprising that the incandescent lamp, a relatively small item so far as expense is concerned, is sometimes considered of secondary importance. Yet it is the final transforming device, the arbiter of the success or failure of all efforts directed towards improving the service.

An electric lighting plant exists primarily for the purpose of manufacturing illumination, which is the commodity dealt in. If illumination is sold at a reasonable price and it is satisfactory to the customers no fault will be found with the service, but if it is not there exists a just cause for complaint, for short measure is always a legitimate cause even in an intangible article.

The manufacture of steam power and electric current are but successive stages in the production of illumination. Efficiency in these directions is essential to the economical conduct of the business, but it is not apparent to the customer who sees only the finished product, the quality thereof being almost entirely dependent upon that of the lamp. In all other forms of illumination the quality thereof is almost entirely dependent upon that of the illuminant.

During the past few years there has been but little choice in incandescent lamps so far as initial claimed efficiency is concerned; 3.1, 3 5 and 4 watt lamps are offered. You choose what appears best adapted for present needs, and take what you get.

An incandescent lamp is too often valued according to the number of lamp hours derived therefrom regardless of initial uniformity of candle power, current consumption and candle hours. Most of the prominent lamp makers may be depended upon to furnish initially satisfactory lamps, yet many lamps find their way to the market lacking in even this essential. A series of recent tests are presented to illustrate this:

Test No. 1.—Selected at random from a lot of 16 c.p. 110 volt 3.1 watt lamps and tested at their rated voltage:

C. P.	Watts.
17	50
20	55
15.1	50.2
17.9	72.1
15.5	60.6
Average 17.1	57.58..3.37 w.p.c.

Test No. 2.—Selected at random from a lot of 16 c.p. 110 volt 3.5 watt lamps, tested at rated voltage:

C. P.	Watts.
17.25	71.8
17.25	62.8
15.25	67.7
17	68.2
17	67.1
17.5	73.7
Average 16.88	70 .....4.1 w.p.c.

The conditions shown by the above tests are not frequently met with now, another method having been adopted to secure the same results, as shown in test No. 3, selected at random from a lot of 16 c.p. 111 volt 3.1 watt lamps:

C. P.	Watts.
14.6	49
12.5	49.5
14.5	49
14.65	49.8
Average 14.06	49.33....3.5 w.p.c.

Test No. 4.—From a lot of 16 c.p. 105 volt 3.5 watt lamps:

C. P.	Watts.
11.25	58
11	54
10.25	54
Average 10.8	55.3....5.1 w.p.c.

It will be noted that the total watts consumed by these lamps would not be excessive were they of full candle power, but it is excessive for the amount of light actually delivered. A wattmeter would not detect this fault in the third and fourth lots but would in the first and second.

It is not meant to convey the impression that all lamp makers impose upon their customers in this manner, yet it is done more frequently than is generally believed. The only sure check is for every company to equip itself with a first-class lamp testing outfit. It is not expensive and is really a necessity.

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*Abstract of paper read at the Northwestern Electrical Association Convention held at Sheboygan, Wis., June 26-28, 1901.

A standard portable voltmeter and an ampere or wattmeter should be possessed by every electrical station. The photometer alone would be devoted exclusively to lamps and can be had at an exceedingly low price, so cheap in fact that no company can afford to be without one. The immediate result of persistently photometering all lamps is shown in Test No. 5, selected at random from a lot of 16 c.p. 110 volt 3.1 watt lamps:

	C. P.	Watts.
	15.75	49
	16.4	48
	16.5	48
	16.25	49
	16.75	50
Average	16.33	49.8...3.05 w.p.c.

From the statement made with reference to the initial efficiency of lamps it might appear that no advance has been made in the art of lamp making, but in fact there have been great improvements. The lamp of to-day has a better candle power curve and is more uniform and when operated under similar conditions will give better service than its predecessor.

It is unreasonable to expect the best results from lamps operated on a fluctuating voltage, particularly if the fluctuations carry the voltage above normal. They will doubtless stand 2 or 3 per cent. increase, but the result will be shorter life and fewer candle hours. The following table shows the effect of increased voltage upon the candles, total watts, watts per candle and life of the 3.5 watt lamp:

Per cent. voltage.	C. P.	Watts.	W.P.C.	Per cent. life.
100	16	56	3.5	100
101	17	57.2	3.37	81.5
102	17.9	58.4	3.26	67.8
103	19	59.6	3.14	65.6
104	19.9	60.9	3.06	48.2
105	21	62.2	2.96	40.2
106	21.8	63.5	2.9	30

The contrast between a new lamp and one that has burnt a few hundred hours is very slight when operated at normal, but becomes more marked as the voltage increases. Increase in the voltage to give a good light itself defeats the end most desired. Though the lamp will burn brighter at first after a short while the candle power curve shows a marked decline and soon falls below that of a normally operated lamp, so that during the latter part of the life it is really dimmer.

It is also erroneous to assume that a lamp burnt on a fluctuating voltage will give the best results even though the average of the voltage is the same as the normal voltage of the lamp.

As is well known all lamps gradually lose their brilliancy almost from the moment they are put into service. A lamp's value is determined by its watts per candle power and candle hour area, or in other words, by the amount of light derived from the current consumed.

The current consumed by a lamp during its life is worth ten fold more than the lamp itself. It is estimated that the cost of free renewals will not exceed 15 per cent. of the total expenses, so we may assume the 85 per cent. representing fuel, labor and maintenance is the cost of the electric current, all of which is consumed in the lamps for the production of light. Is it not of importance then to know what is received for the greater part of the expense account? For this the use of a photometer is essential, and should be a part of the regular work of every station.

Unfortunately it is not, and inconsistent as it may seem there are those who doubt the reliability of the photometer, while insisting strenuously that they want correctly rated lamps.

It is argued that the personal equation enters into the work with a photometer to such an extent as to render it almost impossible for two workers to agree, and that under the very best of conditions only approximate results can be obtained, consequently there is little satisfaction in working under the conditions ordinarily prevailing in a central station. Further, that as a number of factories furnish satisfactory lamps without being checked up they will continue taking their chances, particularly as their employes are usually busy on other work which appears to yield a better and more immediate return.

Admitting that absolutely exact work cannot be done, we know that the photometer is exceedingly reliable, and by using an incandescent lamp for a working standard and exercising proper care, the percentage of error will be negligible, especially where comparative tests only are made.

That it is impossible to secure ideal conditions for testing lamps in the ordinary central station is also admitted. If the refinements of a lamp are to be brought out, it is better to have the work done in a laboratory equipped for the purpose, but ordinarily it is more important to learn what results are being secured under the prevailing conditions. This will show what the customers are actually getting.

If the test shows the lamps to be unsatisfactory the trouble may be looked for in the voltage regulation, in the lamps, or in both. In testing not only should different makes and types be tested, but also lamps of different voltages and efficiencies. It is frequently more desirable to make the lamp fit the voltage, than to change existing voltage conditions. Particularly is this so if the voltage has been carried above normal, because, were it reduced the old lamps on the circuit would burn so dimly as to make it necessary to replace them. Therefore it is better to determine just what lamps are best suited for the service and adopt them. By exercising great care in making these tests it will be possible in many instances to find 3.1 watt lamps so satisfactory that their use would be warranted.

The useful life of a lamp is determined by the number of hours it burns before losing 20 per cent. of its rated initial candle power. A simple method for determining the candle hour area is to multiply the average candle power by the number of hours in its useful life.

Until quite recently the highest efficiency offered in 220 volt lamps was 4 watts per candle power, but now an exceedingly satisfactory 3.7 watt lamp is offered and recommended for general use. The filament of this lamp is unanchored. The useful life is about 650 hours and the area about 10,000 candle hours.

There is not nearly as much trouble in systematic lamp testing as is generally supposed. For a medium or small station an average of 30 minutes per day or 3 hours per week will usually suffice. If 10 per cent. of the lamps received are measured initially a criterion of the entire lot is secured. If they are accepted one lamp from each barrel should be placed in life test and another as nearly as possible the same initially, preserved against the accidental breakage of the test lamp, when the test may be started again with this second lamp. The readings may be taken after every 100 hours' burning, the candle power curved, plotted and the area calculated.

A suitable test rack may be placed at some convenient point where it is possible to keep an accurate account of the hours of burning. As the object is to learn the area delivered to the customers it is neither necessary nor desirable to make an effort to deliver a more uniform voltage to the test lamps than to those in regular service.

By testing different makes of lamps in this manner it will soon be determined which is the most satisfactory for permanent use. The most satisfactory results secured from each test (if there are several lots) may be adopted as the standard for comparison. This standard may be changed from time to time as better results are secured.

This will place the lamp maker in a position to compete on the basis of the merit of his lamps and an incentive is offered for greater effort on his part to improve the quality thereof. By constantly demanding a better lamp than heretofore received, and what is more important, knowing when it is received and being willing to pay for it, will soon bear fruit.

There is no reason why lamps should not be bought on the basis of their true worth rather than as simply so many glass bulbs, brass bases and filaments. In buying a boiler, engine or dynamo it is not customary to call for so many pounds of iron, steel, copper and brass. Efficiency and service is required and considered of first importance, and any increase in efficiency will command a premium. This has been productive of good results, as an ordinary efficiency of 95 per cent. in an engine or dynamo will witness. The efficiency of an incandescent lamp is at best not above 5 or 6 per cent., so that there is room for improvement without splitting hairs.

Electrically Driven Public Carriages in Paris.

Electrically driven public carriages in Paris are not a brilliant success and one of the principal reasons for the bad results is certainly due to the high fares and the small number in use. It has even been announced that they are to be withdrawn from service, but this arose only through a suspension of the service to provide for improvements, for justly the accumulators employed by the company would only drive the carriages 44 kilometers without relays. On account of the charging station being situated at Aubervilliers, distant 5 kilometers from the center of Paris, there practically resulted only 34 kilometers of actual service from each charge, because 10 kilometers were taken up in going and coming from the charging station. The available distance service did not permit of a commercial profit from the undertaking. The equipment is going to be changed very soon by employing a new battery, which the company is at present engaged in installing. It will permit of a 90 kilometer run without recharging. The actual number of carriages in service is 100.

THE PREVENTION OF ACCIDENTS ON ELECTRIC TRAMWAYS.

The numerous fatal and other accidents to persons which have occurred in connection with the operation of electric tramways in different towns in Germany, and to some extent in Austria, during the past few years, says the "Engineer," London, have at last engaged the attention of the Governments of those countries with the object of means being devised for the prevention of such occurrences in the future. As far as Germany is concerned, the question of protecting the public from the dangers of electric tramways is not new, since it has been under consideration for a long time in various parts of the country. In Hamburg, for instance, the city authorities, as long ago as the year 1897, appointed a committee to investigate the subject, and after deliberations and experiments extending over three years, the committee was able to present its report at the end of January of the present year. The report, which can scarcely be regarded as a satisfactory document, submits that no useful protective appliance for tramcars has yet been brought into existence. It appears that the committee made tests with all available kinds of apparatus, but came to the conclusion that none of them fulfill the desired object. The report includes in this condemnation the protective device introduced in Hanover, upon which considerable anticipations had been based. In this connection a comparison of the tramway network in Hamburg and Hanover shows that the former is three times more comprehensive than the latter; and yet the fatal accidents due to tramway working in Hanover during 1899 were more numerous than in Hamburg, where no special protective appliance is in use. The only suggestions contained in the report are that the number of cars in the congested thoroughfares should be reduced, and that the public should be requested to exercise more caution in the streets.

Whilst this inconclusive report was in course of preparation the German Government, in consequence of the many accidents in Berlin, authorized the Minister for Public Works and the Minister for the Interior to convene conferences of representatives of the police and other supervising authorities, and of the Berlin Tramway Company, in order to discuss the position of affairs. After various sittings the Government authorities soon arrived at a decision, and their conclusions were made public at the beginning of February. In the first place, it is stipulated that some of the existing types of brakes shall in a small, and then in a greater measure, be applied to the cars in Berlin, and a series of experiments conducted with them. Secondly, the company is to submit proposals for preventing a passenger, on stepping on to the rear platform of a motor car, from falling in the space between the motor car and the trailer, and thus being run over by the latter. It is further suggested that the speed of the cars should be somewhat reduced, especially on rounding curves, at street crossings, and where children are playing in groups, that special attention should be paid to the instruction of the car drivers in the performance of their duties,

This is the position of affairs in Germany; but in Austria, where electric tramways have not developed to the same extent as in the former country, the question of street accidents has as yet not occupied much attention. It should, however, be noted that the Austrian Government has decided, in the case of the Vienna company for the working of the municipally-owned tramways, only to grant permission for the construction of other electric tramways when the company has adopted provisional protective appliances for the prevention of accidents on the existing lines. The testing of various apparatus is, therefore, now being carried out officially at a considerable cost to the company.

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LONDON NOTES.

[From our London Correspondent.]

English Trolley Lines and Electrolysis.

Quite recently there has been an organized movement on the part of English gas and water companies to get certain clauses inserted in powers for new tramway schemes protecting their interests against the electrolytic corrosive effects of the return current. They have received distinct support from several leading electrical professors, among them Professors Ayrton, Perry and Dewar; but against their application, the great strength of the electrical engineering industry, and in particular of those interested in traction development, has been produced. If the requests of the water and gas authorities had been granted, electric tramway development would have experienced a setback, inasmuch as all new schemes brought before the public for investment would have hanging over them, as a sword of Damocles, an indefinite future responsibility and financial liability. The practical side of the evidence given before the Parliamentary Committee which has been considering the matter, was to the effect that underground pipes are adequately safeguarded by existing Board of Trade regulations. Prof. John Perry considers that insulated returns should be employed by the London United and other tramway companies, and he estimates the cost of this at £400 or £600 beyond the present outlay per mile of line. The committee has now come to the conclusion that there is no real reason for granting the companies any further protection. The decision is important as other companies in the provinces had undertaken to abide by the ruling in the London United Tramway Company's case. The view of Sir W. H. Preece is that the present regulations are sufficient, but that there should be more Board of Trade inspectors appointed to see that they are carried out.

Professor Ayrton, F. R. S., a past president of the Institution of Electrical Engineers, said that it had been urged that the Board of Trade regulations, if complied with, would prevent the destruction of pipes occurring at the rapid rate at which it had occurred in America; but there was nothing in these regulations to prevent current being sent by electric traction through pipes and considerable damage being consequently caused. Investigations with regard to two gas-pipes at Liverpool in a street where electric trams had been running since November, 1898, showed that, although one was laid in August, 1899, they were both affected by electrolytic action. He maintained that iron might be eaten away if laid in sand moistened with saltish water, even when the pressure of the electricity was far less than that allowed by the Board of Trade. They made a test of the currents on Saturday and Sunday, working from 10 o'clock P. M. to 4 A. M. While the trains were running they found from 130 to 140 amperes of electricity in the four rails. As the cars stopped the current became less and less. At 2.30 A. M., when everything was shut down for the night at the generating station, there was a current in the rails of 20 amperes. That was very startling as everything was shut down If the current was due to natural causes it was obvious that it would not merely operate between Chiswick and Kew, so they went west towards Brentford. They found, as they proceeded, that the current became less and less, and that it flowed in the opposite direction. They, of course, were of the opinion that if the current was due to ordinary natural causes they would find it in the pipes. They had a hole made in the Chiswick-road, near the fire station, at 3:30 on Sunday morning and tested the water and gas pipes and found practically no current passing through them. The conclusion he came to as the result of his experiments was that the current flowed from the generating station east, west and north; he found that the night current was one which affected the pipes of the water and gas companies, but that when the cars were running in the day time there was a current running through the pipes.

Prof. Dewar stated that the only effectual protection against electrolysis would be to have insulated returns. The protection would be increased as the currents circulating in the pipes were diminished. It would not be easy to ascertain the origin of the currents circulating in the pipes. Legal power to suspend the working of the tramways for a time to make experiments would be necessary. If that were done they would indicate who was the author of the mischief.

The regulations should insist on far less current being allowed to circulate in the pipes. They could still work the tramways. Each diminution in the quantity would be a nearer approach to an insulated return.

* * *

PARIS LETTER.

Special Correspondence of Electricity.

The Electro-Technical Institutions of France.

Schools in electricity have not been organized in France except in a very incomplete manner up to the present time, and for this reason young students in electricity who desired to receive a practical education were necessarily sent to special schools established in foreign countries, especially those of Belgium and Switzerland. At the present time the situation has been much improved. Among the technical establishments attached to the colleges, or to the universities, have been industrial electrical laboratories where electrotechnical teaching holds a high position. Besides the Paris School of Electricity, which gives engineering diplomas, the following are from the provinces: The laboratory of industrial electricity established at the Bordeaux Faculty of Sciences; another at Claremont; a laboratory of industrial electricity in connection with the Faculty of Dijon; an electrotechnic institute has been annexed to the University of Lille; another to the University at Montpellier; still another special electro department with the University at Grenoble, and a similar one at Nancy. This last institute of electricity has recently been created through the help given by the manufacturers, the Consul-General and the Municipal Council of that locality. The State will have no more than 15,000 francs to pay for its support each year, which sum will be used for the professors' salaries. The installation comprises two pavilions, inclosing a testing laboratory for dynamos, a work-shop, a laboratory for measurements of precision, a hall for accumulators, several rooms for electrical measuring apparatus, and the ground-floor is taken up by the engine room and the photometric room. The library is on the first floor together with a dark room and a conference chamber. The object of this institute is to furnish electrical engineers, who will receive at the end of three years a diploma for studies in electro-technics. This institute will also be placed at the service of manufacturers for testing and measurements and to those who would desire to consecrate themselves to special researches in theoretical or applied electricity. With all the Parisian schools, this institute and the total number of other laboratories can very well compete to advantage with the instruction secured in foreign schools. Finally there is to be opened at Paris very soon a practical school of industrial electricity, at 53 Billiard street, which will be especially adapted to meet the requirements of individuals who wish to acquire the necessary useful knowledge to direct or construct electrical installations. The course of studies will take two years and will be of an essentially practical nature, composed from the start of courses of study and manipulations of engines, machines and apparatus, exercises in the laboratories and visits to work shops. This school is destined to furnish superintendents for the electric generating service. A course in automobilism has been added to this school and it will treat of the construction, operation, maintenance and the running repairs of automobiles.

The New Lines of the Parisian Metropolitan Street Railway.

On account of the first success obtained in the operation of the first line of the Metropolitan Street Railway, which is 14 kilometers in length, running from the Porte de Vincennes to the Porte Maillot, and which has carried 16,000,000 passengers in six months, the officials are about to add the second line to the one already in operation. This line is made up of two sections, the first one, the North Belt, running from the Porte Dauphine to the Place de la Nation, through the outer boulevards, having a length of 11.3 kilometers. There will be an underground construction of 5,800 meters, an overhead line of 2,100 meters, and a new underground line of 4,400 meters. There will be 25 stations. The second section, or South Belt, will have a total length of 11,500 meters, of which 6,000 will be subterranean and 5 200 through a viaduct, and it will have 23 stations. Work on these two sections will be commenced immediately and will be actively pushed.

The Electric Lighting of Trains by the Compagnie de l'Est.

Following the example set by the Compagnie du Nord, the Compagnie de l'Est has just installed, as an experiment, electric lighting in its trains. The Vicarino system is used. This system contains a small dynamo operated by frictional contact with the axle together with an accumulator and an automatic switching device for each carriage. When the train stops the automatic switch connects the lamps with the battery, which latter has a capacity of 60 to 100 ampere hours; when the car is in motion and the dynamo has acquired sufficient speed, the switch automatically disconnects the accumulator and connects up the lamps to the dynamo; the speed of the dynamo is 1,200 revolutions per minute, which is attained by the average speed of the train.

The Exposition of Hanoi in 1902.

This Exposition will be open November 3, 1902, and in it will be represented France, the French Colonies, Chinese India and the countries of the extreme East. The ground for this Exposition was broken about a month ago. The principal palace, which will later be used as a museum for Tonkin, will occupy the central position on the exposition grounds and will cover 12 hectares; it will have a frontage of 100 meters and a depth of 25 meters; it will contain colonnades which will form a veranda and galleries. The back part of the palace will be reserved for the exhibition of industrial products. All the industries of the natives, as well as the European industries, will be shown, power to be furnished by electric motors. All the buildings and gardens will be lighted by electricity.

ALBERT L. JOHNSON DEAD.

The Famous Railroad Man Succumbed to an Affection of the Heart—Sketch of His Life.

Albert L. Johnson, the trolley-road owner and promoter, died at Fort Hamilton, Brooklyn, on July 3, of heart disease, after a brief illness. It is said that he might have recovered had it not been for the extreme heat.

Albert L. Johnson, better known as Al. Johnson, was born near Helena, Ark., on December 24, 1860. Here his father maintained a large plantation. At the outbreak of the war his father joined the Confederate forces and was made a colonel in the Confederate army. When the war ended he returned to his plantation only to find it desolated. His slaves had deserted and left him impoverished, without money to repair his damaged property. He abandoned the plantation and went to Louisville, and here it was that Al. and his brother Tom had their first occupation. Al.'s. first position was that of errand boy in a small store. When 12 years old he obtained employment with the Pullman Company, where he received his first instructions in the railroad business. In 1876 he went to Indianapolis, where his brother Tom was superintendent of a street car line, and went to work as a conductor. Subsequently the car barns burned down, destroying a lot of valuable stock, including most of the horses. Always a lover of horse-flesh he had acquired a knowledge of horses which stood him in hand at this time, and he was delegated to purchase new stock for the road. Later he became foreman of the barns and finally superintendent of the road. He and his brother Tom then became financially interested in a number of street railway enterprises with W. H. English, once a candidate for Vice-President of the United States, and gained their original capital in that way.

With this capital they went to Cleveland where they inaugurated a new era in street railways. Tom was the financial and Al. the operative manager, and they remained the controlling factors in the Big Consolidated Company until about ten years ago, when they disposed of their holdings and transferred their talents to the East.

The greatest of Al. Johnson's exploits in the railroad business was the building of the Nassau System in Brooklyn about six years ago. He experienced considerable trouble in obtaining the necessary franchises, the chief objection being that his lines would parallel others already operating and that there was not sufficient traffic for all. Then when the franchises were finally awarded to him, the difficulty he had encountered made the obtaining of money with which to lay tracks and purchase rolling stock, a hard task. It is said, however, that his brother Tom came to his assistance and he was able to make the Nassau a great system, much to the annoyance of those who had opposed his schemes. About two years ago he sold out and he always said that the earnings of the company and the large dividends paid warranted him in asking a much larger price for his holdings than he had received.

Mr. Johnson's pet idea was to inaugurate a three-cent fare in Philadelphia, and gradually to extend this system to New York. It was his intention to build a tunnel from Staten Island to Brooklyn, to connect with a tunnel from Brooklyn to Manhattan, but he did not live long enough to press these schemes. But the three-cent fare system, Mr. Johnson said, would be the work of his life, and those who knew him well believed that he would soon introduce the innovation in Philadelphia in connection with his great scheme of paralleling every street car line in that city. Already he had progressed so far as to give the Widener-Elkins syndicate in that city a big scare by gradually extending his original line in Allentown, Pa., by building or by purchase, until it reached to a suburb of Philadelphia, a distance of sixty-five miles, and was running his cars at fast time and charging extraordinarily cheap fares between the towns. At the entrance to Philadelphia his scheme seemed to be blocked and it seemed impossible for him to get a franchise for the streets of Philadelphia. But this, he said, was only a temporary setback, and he set about trying to purchase old lines in the city or wait until he was able to occupy the streets with new ones.

Mr. Johnson was intent on giving the people of Greater New York better service and cheaper fares, and to this end he proposed to run a line from Jersey City to Staten Island, thence through a tunnel to Brooklyn, and another to Manhattan. In preparation for this plan he had cars built and some of them are now running on the lines in Allentown. They are capable of a sustained speed of fifty miles an hour.

Mr. Johnson will be long remembered as the best friend of the railroad employe, who held him in the highest esteem. He had a system of paying his men by the hour from the time they boarded their cars until they finished their work for the day. If a car was blocked or delayed on the road the conductor and motorman suffered no loss as a consequence, which was a distinct departure from the old method of paying the men a certain amount for each trip, whether it consumed an hour or a day. In twenty-five years of street railway service Mr. Johnson never had a strike or other labor disturbance on one of his lines. The reason for this was that he was thoroughly democratic. His office door was always open to his employes, and if they had a grievance they laid it before him and it was adjusted. The same rule applied to his home, and when he was living in Bensonhurst at the time he was operating the Nassau line in Brooklyn, every evening when he sat on his porch some of his railroad employes would call to see him, and they were always welcomed.

All of Albert L. Johnson's great trolley schemes will be carried out as far as practicable by his brother, Tom L. Johnson, mayor of Cleveland. This announcement was made by James Lynch, who was A. L. Johnson's right-hand man in the management of his enterprises. Mr. Lynch said:

"Mr. Johnson's death will not affect the operation of his trolley roads in Pennsylvania. His plan to connect New York and Philadelphia by trolley and to carry passengers between the two cities for 50 cents will be pushed by his brother, Mayor Johnson, and the accomplishment of the project is more than probable. Mr. Johnson's plan to unite small trolley systems of Pennsylvania into one system will also be pushed by his brother, who will as far as practicable carry on the work that was left unfinished by Mr. Johnson's death."

Westinghouse Company Say Patents Are Infringed.

On Saturday last in this city a bill of complaint was filed in the United States Circuit Court by Gifford & Bell, attorneys of 141 Broadway, in behalf of the Westinghouse Electric & Manufacturing Company, against the Lorain Steel Company and H. C. Evans, its agent in this city. The suit is for infringement of patents claimed to be owned by the Westinghouse Company, and the court is asked to issue an injunction restraining the defendants from continuing to manufacture dynamo electric machines invented by Norman W. Storer in 1892, the patents for which it is claimed were assigned to the Westinghouse Company in 1896. It is also asked that an accounting be had to compel the defendants to pay to the Westinghouse Company the amount of loss sustained by them through the sale of the alleged machines.

Proposals Invited.

Sealed proposals are being invited until July 27, for furnishing and installing an electric light plant at Fort Washington, Md. Detailed information will be furnished intending bidders upon application to Lieut. Col. C. J. Allen, Corps of Engineers, U. S. A., Washington, D. C.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended July 3:

Amsterdam, 13 cases, $1,450; Antwerp, 78 packages, $3,865; Argentine Republic, 157 packages, $5,201; 1 motor carriage, $850; Australia, 9 cases, $267; Barcelona, 15 cases, $900; Bordeaux, 2 cases, $50; Brazil, 28 packages, $2,641; British East Indies, 7 packages, $152; British West Indies, 14 packages, $289; British Guiana, 19 packages, $241; Central America, 22 packages, $820; Chili, 68 packages, $883; Cuba, 133 cases, $7,574; Genoa, 2 cases, $366; Glasgow, 16 packages, $637; Hamburg, 73 cases, $7,294; Havre, 3 cases, $1,155; Japan, 85 packages, $978; Liverpool, 82 packages, $13,553; 66 cases, $3,023; London, 637 packages, $22,146; Mexico, 23 packages, $895; Manchester, 33 cases, $2,285; New Castle, 30 packages, $15,000; 11 cases, $1,275; Peru, 75 bundles telephone wire, $225; 35 packages, $1,029; Rotterdam, 1 case, $105; Southampton, 35 packages, $1,951; Sheffield, 53 cases, $4,676; U. S. Colombia, 46 packages, $2,201; Venezuela, 4 packages, $64; Vienna, 9 packages, $203.

INCORPORATIONS.

The Brookfield Gas, Electric & Heating Company, Mascoutah, Ill. Capital stock, $25,000. Incorporators: Joseph W. Wyne, John M. Keefer and Henry H. Stephens.

The National Electrical Construction Company, Pierre, S. D. Capital stock, $5,000,000. Incorporators: E. R. Longen, W. J. Moss and J. E. Hipple.

The Thornapple Electric Company, Grand Rapids, Mich. Capital stock, $100,000. Incorporators: Wesley W. Hyde, S. D. Kopf and Charles E. Mercer, all of Grand Rapids.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 2, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

677,463. Frog for Use in Connection With Overhead Conductors of Electric Tramways or Railways. Hugh C. Nicholson, Bellevue, Ireland. Filed April 12, 1901.

677,523. Car-Fender. Samuel Lind, Davenport, Ia. Filed Jan. 18, 1901.

677,532. Yielding Automatic Adjustable Car-Fender. Scott W. Alexander, Los Angeles, Cal. Filed Sept. 6, 1899.

677,778. Electric-Switch Railway. Andrew L. Hatfield, Newark, N. J., assignor to Frederick N. Riggs, same place. Filed June 20, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

677,877. Globe-Holder for Arc-Lamps. George E. Stevens, Lynn, Mass., assignor to the General Electric Company of New York. Filed July 28, 1899.

677,605. Electric-Arc Lamp. Thomas Spencer, Philadelphia, Pa., assignor to the Helios-Upton Company, same place. Filed Feb. 19, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

677,340. Electric-Switch. Allan Cowperthwait and Nils O. Lindstrom, New York City, assignors to Alonzo B. See and Walter L. Tyler, Brooklyn, N. Y. Filed Feb. 4, 1901.

677,355. Regulation of Dynamo-Electric Machines. Henry M. Hobart, Berlin, Germany, assignor to the General Electric Company of New York. Filed Jan. 5, 1901.

677,392. Armature for Dynamo-Electric Machines. Charles De Witt Anderson, Chicago, Ill. Filed Aug. 27, 1900.

677,455. Switch for Multiphase Alternating Current Motors. Koloman von Kando, Budapest, Austria-Hungary. Filed Dec. 31, 1900.

677,533. Casing for Dynamo-Electric Machines. Charles De Witt Anderson, Chicago, Ill, Filed Oct. 14, 1899.

TELEPHONES AND TELEPHONE APPARATUS.

677,331. Time Indicator for Telephones. Thomas Barnet, Sydney, New South Wales. Filed Jan. 20, 1899.

677,409. Telephone Receiver. William D. Gharky, Philadelphia, Pa. Filed Sept. 4, 1900.

677,410. Operator's Suspension Set for Telephone Switchboards. William D. Gharky, Philadelphia, Pa. Filed Sept. 19, 1900.

677,724. Automatic Telephone-Switch. William D. Watkins, San Jose, Cal., assignor of one half to John W. Bolster, same place. Filed Oct. 18, 1900.

677,807. Coin-Collector for Telephone Toll-Lines. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 30, 1900.

MISCELLANEOUS.

677,335. Electric Soldering Device for Can-Capping Machines. Julius H. C. Buerstatte, Manitowoc, Wis. Filed Sept. 17, 1900.

677,348. Carbon Brush. Walter C. Fish, Lynn, Mass., assignor to the General Electric Company of New York. Filed Feb. 28, 1901.

677,353. Circuit-Breaker. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 29, 1900.

677,359. Electromagnet. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Elevator Company, East Orange, N. J. Filed April 17, 1900.

677,360. Electric-Current Controller. Charles H. Keeney, Milwaukee, Wis. Filed May 6, 1901.

677,371. Electrical Distribution. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed June 12, 1899.

677,375. System of Electrical Distribution. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company of New York. Filed May 24, 1900.

677,399. Electric Vulcanizer. Andrew J. Conlin, Cambridge, Mass., assignor to the Simplex Electrical Company, Boston, Mass. Filed Sept. 10, 1900,

677,424. Transmission System for Mail or Other Service. George A. Owen, Springfield, Mass. Filed Oct. 15, 1898.

677,439. Electric-Arc Furnace. Ramon C. Contardo, Sevres, France. Filed Aug. 24, 1900

677,453. Telegraph Switching Apparatus. Francis W. Jones, New York City. Filed March 16, 1901.

677,477. Electric Detonator-Fuse. George Smith and David Corrie, Polmont, Scotland. Filed Feb. 23, 1900.

677,479. Electrical Rosette Cut-Out. George B. Thomas, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing Company, same place. Filed March 22, 1901.

677,498. Electric-Current Interrupter. Eugene W. Caldwell, New York City. Filed May 4, 1899.

677,499. Method of Interrupting Electric Currents. Eugene W. Caldwell, New York City. Original application filed May 4, 1899. Divided and this application filed May 20, 1901.

677,519. Protection of Multiple-Telegraph Instruments. Francis W. Jones, New York City. Filed Feb. 13, 1899.

677,535. Telegraph Apparatus. John Burry, Fort Lee, N. J. Filed Nov. 20, 1899.

677,578. Apparatus for Purifying Liquids by Electrolysis. Frederick W. Lemp and William Koedding, St. Louis, Mo. Filed Oct. 1, 1900.

677,581. Mechanism for Transmitting the Readings of Ships' Compasses to Distant Points. Eberhard F. W. von Mantey, Kiel, Germany. Filed April 20, 1900.

677,584. Electric Mandolin Player. Alexander I. Mitchell, Rumford Falls, Me. Filed Feb. 25, 1901.

677,633. Zinc Element for Galvanic Batteries. Horatio J. Brewer, New York City. Filed March 25, 1901.

677,652. Portable Electric Battery. Manes E. Fuld, Baltimore, Md. Filed May 17, 1900. Renewed May 21, 1901.

677,659. Relay. Reinhold Herman, Crafton, Pa. Filed Nov. 21, 1900.

677,661. Apparatus for Regulating Pressure in Electric Mains Connected to Storage Batteries. John S. Highfield, St. Helens, Eng. Filed March 12, 1901.

677,730. Process of Insulating Conductors. Clinton E. Woods, Chicago, Ill., assignor of two-thirds to Peter F. Turner, same place. Filed April 12, 1901.

677,741. Means for Supporting and Manipulating Contact-Shoes of Electrically-Propelled Railway-Cars. Herbert C. Hastings and Louis E. Walkins, Springfield, Mass., assignors to Henry A. Chapin, same place. Filed Feb. 21, 1901.

677,771. Means for Connecting Differential Gearing to Driving-Axles of Vehicles. Edward T. Birdsall, New Rochelle, N. Y., assignor to the Desberon Motor Company, same place. Filed Oct. 5, 1900.

677,772. Electric Whistle. Stuart A. Brown, Mount Fair, Va. Filed Dec. 16, 1899.

677,783. Controlling Device for Electrical Door-Openers. George A. Le Fevre, New York City. Filed July 30, 1900.

677,801. Printing-Telegraph. John Rogginer, Milwaukee, Wis., assignor to the Falk Company, same place. Filed Nov. 6, 1899.

677,819. Electric Self Winding Clock. David W. Thompson, Chicago, Ill. Filed Feb. 3, 1900.

677,826. Controlling Means for Electric Circuits. Richard Varley, Jr., Jersey City, N. J. Filed Aug. 16, 1900.

677,829. Electric Alarm. Max Wescher and Paul Wollenhaupt, Cologne, Germany, assignors to Walter Rubell Duisburg, Germany. Filed Dec. 21, 1899.

677,843. Automatic Electric Cut-Out. Frederick H. Rogers, San Jacinto, Cal., assignor of one-half to Thomas T. Porteous, same place. Filed Aug. 14, 1900.

REISSUES.

11,917. Process of Duplicating Phonograms. George H. Stevens, Toledo, O. Filed Oct. 11, 1900. Original No. 650,431, dated May 29, 1900.

11,918. Electric-Motor Regulator. Walter H. Knight, New York City, assignor to the Thomson-Houston Electric Company of Connecticut. Filed June 7, 1901. Original No. 428,169, dated May 20, 1890.

COMMERCIAL PARAGRAPH.

Boiled linseed oil 73 cents a gallon. A feature of the protective paint market is the price of linseed oil. The steady advance in the cost of pure oil and pigments has caused the market to be flooded with adulterated and second-grade paints. "Economics of Protective Painting" show that the most durable paint is the profitable one. Simplify the problem of economy in construction and maintenance painting by asking for the durability records of Dixon's Silica-Graphite Paint. It has been in use for thirty-eight years in different climates. "Best Production" Dixon success in the protective paint market. Dixon's Silica-Graphite Paint is manufactured in only one quality, and of the very purest materials obtainable. Address Joseph Dixon Crucible Company, Jersey City, N. J.

THE TELEPHONE WORLD.

Kentucky Independent Companies to Fight the Bell Company.

The third annual convention of representatives of independent telephone lines in Kentucky adjourned at Lexington a short time ago after two interesting sessions. The association grows out of the trust formed by the Bell telephone people and the discrimination in rates. Independent exchanges have been established in some 20 towns in Kentucky, those in Louisville and Lexington and some of the other towns being larger than those of the old company. As the result, the old company has been cutting rates, and the matter will come before the Legislature.

Secretary James Maret, of the association, who was one of the promoters of the association idea, said that at present over $2,000,000 was tied up in independent telephone companies in Kentucky. Five years ago there was less than $5,000. When the association was first formed three years ago there were less than 600 independent 'phones operating in the State. Now there are close to 17,000. Then there were about 500 miles of pole lines—now there are over 4,000.

The first convention of the Kentucky Telephone Association was held at Crab Orchard. It started with 17 company members, and with the recent new additions now numbers 35.

Telephones are being placed in the homes of dozens of farmers in Western Missouri, Kansas and Oklahoma. An official of the Missouri & Kansas Telephone Company said recently that that corporation has two special men working in Jackson and adjoining counties soliciting farmers to put in 'phones, and that they are meeting with marked success. They secured 16 contracts near Smithville in Ray County; about 20 near Clinton, Henry County, and think they will be able to get at least 25 near Lee's Summit, several near Lone Jack and a large number near Independence, all in Jackson County. "It would surprise you," this official continued, "to know how many Oklahoma and Kansas ranchmen are putting in 'phones. Numbers of them are a good ways from a railway station. They are anxious to keep in close touch with the market, and they find the telephone both serviceable and inexpensive for this purpose."

The Ann Arbor, Mich., common council paid the Bell telephone people for the telephones in use by the city under protest, a short time ago. A number of the aldermen spoke vehemently against the present unsatisfactory service and a motion to order out all the city's 'phones came within only two votes of passing. Manager Keech assured the council that by the middle of next September a new switchboard would be put in and that then the service would be all that could be desired. The action of the common council indicates the feeling prevalent among telephone users throughout the city. Many business men assert that they will refuse to pay their rentals until the service improves, and then only the full rental when forced by the courts. Franchises for two new independent telephone companies were offered at the council meeting but were referred to the city attorney for rearrangement before being read and acted upon.

A report from Jasper, Ind., says that a lively competition between the Cumberland Telephone Company and the Dubois County Telephone Company is threatened, and really it has already begun, as the Cumberland Company is putting in free boxes in the court house. A number of patrons have ordered out the Cumberland 'phone, substituting the Dubois County boxes, on account of the free service outside the county limits. Competition in long-distance service is badly needed throughont Southern Indiana, and it is hoped that the present strife may result in reasonable rates to distant points.

There was a recent meeting of the officers of the Dutchess County Telephone Company of Poughkeepsie, N. Y. Four of the New York directors had resigned, and their places were filled by William Morgan Lee, Robert H Hunter, Isaac W. Sherrill and Edgar B. Taylor. Mr. Edgar B. Taylor was elected president of the company and Mr. Isaac W. Sherrill secretary and treasurer. Mr. Lee stated that the company expected to have its lines in operation and be ready for business August 1.

Over 25 telephones in Osceola, Wis., belonging to the St. Croix Valley Telephone Company were burned out during a recent storm and communication by telegraph was also cut off for several hours.

The Southwestern Telegraph & Telephone Company has finished putting in the posts between Brownwood and Comanche, Tex., and as soon as the wire can be strung Brownwood will be thoroughly in touch with the outer world.

A telephone line from Ronneby to Foley, Minn., is completed, and the business men are subscribing for an extension to St. Cloud and Sauk Rapids.

Combination of Telephone Lines.

A deal has been consummated at Westminster, Md., by which a controlling interest in the Western Maryland Telephone Company of Carroll County was transferred to Samuel L. Johns, of McSherrytown, Pa., and George D. Gitt, Harry N. Gitt and Thomas J. O'Neill, of Hanover, Pa. These gentlemen had previously purchased a controlling interest in the Gettysburg, Hanover & Adams County Telephone Companies and they expected to get a majority of the stock of the York, Pa., and the Frederick and Hagerstown, Md, systems, their purpose being to combine all these companies under one management, and then to unite with the Maryland Telephone Company of Baltimore.

Telephoning in the Klondike

The telephone has found its way into the Klondike, an exchange having been established in Dawson. In the exchange building are installed four 50-drop switchboards, giving a combined total capacity of 200 drops. At present two more sections are under installation; which, when completed, will give this exchange a capacity of 300 subscribers. Four operators are employed on the switchboards. At present the entire capacity of the exchange is in use in Dawson. The operating company, the Yukon Telephone Syndicate, Limited, also has an exchange at Grand Forks, which is situated at the junction of Eldorado and Bonanza Creeks, 14 miles away. Between this point and Dawson three full metallic circuits are maintained and two way circuits also. The installation at the Forks comprises 54 telephones. Beyond this point two metallic circuits continue to Dome, 30 miles from Dawson, where is installed a combination switchboard with full metallic and ground-return circuits, and upon this two operators are employed during the 24 hours of each day. It must not be forgotten in connection with this far northern installation that the 24 hours of the day are sometimes all daylight and at other times all night. Beyond Dome a good return line extends 12 miles further to Dominion Creek, and a similar line 35 miles long to Gold Run. Thence the line extends to Sulphur, eight miles, and also to Quarter Creek.

This month the Citizens' Telephone Company of Grand Rapids, Mich., celebrated its fifth anniversary, the first service having been given on the independent exchange in that city July 1, 1896. At that time the company had 832 telephones in operation and now the number has increased to 3,588 in Grand Rapids. The company has occupied the same quarters since its organization and as it has a 30-year lease of the building will probably be there for a much longer period. When the company was organized its authorized capital stock was $100,000 of which about $65,000 had been sold. Before the end of the year $85,000 worth had been sold and the capital stock has since been increased so that now it stands at $1,000,000 authorized, of which $565,000 has been sold. E. B. Fisher, now secretary of the company was president of the original company, with C. F. Rood, now president, as vice-president. Amos Musselman was secretary for the first three years, and then when that office was made an executive position, J. B. Ware was made secretary, leaving a short time ago to take the management of the new Detroit company. During the five years of its existence nearly $100,000 in dividends have been paid.

The Eastern Telephone Company of Rockland, Me., has purchased the local telephone line operated by Walter P. Maxim in South Paris and Norway villages, and has petitioned the selectmen of the towns for permits to extend the lines. This addition to the property of this company will doubtless prove valuable as the line at present extends over considerable prosperous territory, where there is an excellent opportunity to enlarge. The growth of the telephone has certainly been wonderful, and the Eastern Company, which is now a comparatively young corporation, has achieved success in localities where its service has been introduced.

The telephone service of the New York & New Jersey Telephone Company is being extended to Smithville South, N. Y. A number of subscribers have been secured and business will soon commence.

The city council of Pekin, Ill., has passed an ordinance for the Citizens' Telephone Company, and fixed the maximum charge for business houses at $36 per year and residences, $24.

Fifteen farmers living west of Lostant, Ill., recently organized a telephone company, ordered poles and wire, and will soon make connection with the switchboard of that village.

A new telephone system has just been put in operation at Staples, Minn., and also a new line built west to Verndale and north to Ellis.

Three Minute Telephone Rate.

Announcement was made by the Long Distance Telephone Company of New York last week that it has adopted the three minute schedule of long distance telephone rates throughout its system of lines. This has been in operation between points west of Pennsylvania and in the South for more than a year and it is now made to apply throughout the Eastern States. The change permits the use of the telephone for three minutes or less on payment of the three minute charge. Formerly it was necessary to pay for at least five minutes.

The Inter Ocean Telephone & Telegraph Company was incorporated lately at Albany, N. Y., with a capital stock of $2,000,000. The company will operate a telephone and telegraph system connecting the following places: Cleveland, O.; Westfield, Buffalo, Niagara Falls, Rochester, Oswego, Ogdensburg, Whitehall, Syracuse, Rome, Utica, Schenectady, Troy, Albany, Poughkeepsie and New York City, Newburg, Goshen, Binghamton, Cortland, Owego, Waverly Elmira, Ithaca, Auburn, Canandaigua, Corning, Hornellsville, Geneseo, Jamestown, Salamanca and other cities and villages in New York State and Jersey City, N. J. The directors are Charles H. Stewart, Joel H. Fuller, Charles B. Stowe and Burt G. Hubbell, of Cleveland, O.; William T. Morris, of Penn Yan and Harry K. Brown of Hornellsville.

Through the efforts of Manager Frank F. Graves, of the Toledo, O., Home Telephone Company, Put-in-Bay and Middle Bass will soon have regular telephone connection with the outer world. Three years ago the Bell Company secured the franchise to furnish service to the islanders, but aside from a telephone between Middle Bass and Put-in Bay, nothing further was done in the matter, and their only means of communication was through the mails and telegraphic service. A short time ago the Bell franchise was revoked, and Manager Graves secured both a franchise from the village and private right of way, and will have the islands connected up by July 15. The poles and cable have been ordered, the contract for laying the cable has been let, and the work of construction will be prosecuted at once. Toledo people will soon be in touch with their favorite summer resorts.

Los Angeles, Cal., is to have a new telephone system. The franchise will go to the highest bidder, and will be for fifty years. The city authorities are assured that the Bell Telephone has nothing to do with the movement, and have made provisions to be inserted in the contract that will securely bind the holders of the franchise not only to build the new system, but which will also prevent the owners from selling out.

W. H. Elliott, H. W. Wood, Frank Orr, A. C. Floyd, Lee Edy, Mark Hawkins, Samuel Wilson, James Settle and Edward Stewart, proprietors of the Hereford & Hatch Telephone Companies of Ralls County, Mo., met recently in Monroe City, and consolidated on the reciprocity plan, giving them connection with all lines in Ralls, Marion, Monroe and Shelby counties.

The Springfield, O., Home Telephone Company of which N. L. Dreyfoos, of Cleveland, is president, was granted a local franchise by the board of public affairs on its cash bid of $2,500, it agreeing to put in residence 'phones for $18, and business for $30. This settles to some extent the telephone war.

TELEPHONE INCORPORATIONS.

The Blue Top Telephone Company of Palke and Clay Counties, Ind.

The Cowanshannock Independent Telephone Company, Armstrong County, Pa. Capital stock, $2,500.

The Country Home Telephone Company, Chicago. Capital stock, $100,000. Incorporators: Albert A Petterson. Edwin T. Manzer and W. E. Lombard.

The Jackson County Telephone Company, Elkville, Ill. Capital stock, $2,450. Incorporators: Chester Schwartz, John D. Hays and C. M. Thornton.

The Farm & City Telephone Company, Farmer City, Ill. Capital stock, $50,000. Incorporators: B. F. Wasson, Lillian B. Wasson and S. W. Clay.

The Metropolitan Telephone & Electric Company, Chicago—to do a manufacturing, mercantile, construction and operating business. Capital stock, $10,000. Incorporators: Max W. Zabel, O. M. Leich and H. L. Hanson.

The Valley Telephone Company, Albany, N. Y.—to operate a telephone system in Waverly, Tioga County and Sayre and Athens, Bradford County, Pa. Capital stock, $75,000. Directors: Joel H. Fuller, Kerm F. Gill, Charles B. Stowe and Burt G. Hubbell, of Cleveland, O.; Frank Pike, of Sayre, Pa.; Fred E. Lyford, of Waverly, N. Y.; and Vine Crandall, of Athens, Pa.

GENERAL ELECTRICAL NEWS.

Lighting.

Albany, Ga.—At a recent election it was voted to issue $25,000 in bonds for the purpose of building a new modern electric light plant.

Burns, Ore.—An electric light plant is to be erected here. H. O. Gates can be addressed.

Butler, Mo.—A waterworks and electric light plant will be built here from plans made by C. Ford, 710 Security Building, St. Louis, Mo. J. L. Stanley, city clerk.

Cartersville, Ga.—This city has voted to issue $10,000 in bonds to build an electric light plant.

Clarinda, Ia.—A stock company is being formed here to erect a new electric light plant.

Culpeper, Va.—J. M. Sputts has been granted a franchise for the erection of an electric light plant.

Decorah, Ia.—The Decorah City Electric Light Company has submitted to the city council a proposition to operate the city waterworks plant by electricity for $1,800 per year.

Deming, N. M.—L. W. Allum is interested in the establishment of the new electric light plant of 1,000 light capacity.

Dickson, Tenn.—The citizens will hold an election to decide the issuance of bonds for the construction of an electric light plant and waterworks.

Faribault, Minn.—The Polar Star Electric Light Company proposes to furnish heat to the business and residence portion of the city.

Florence, Ala.—The Merchants' Association wants to correspond with parties installing electric light and railway plants. H. J. C. Conner, Jr., may be addressed.

Gloster, Miss.—Gloster has voted to issue bonds to build an electric light plant.

Greensburg, Pa.—S. C. Knight, president of the Ft. Wayne Electrical Construction Company, has been here lately looking over the ground preparatory to putting in an electric light plant.

Greenview, Ill.—L. Stone is preparing to erect a new electric light plant in this city,

Gridley, Ill.—P. A. Klopfenstein is contemplating arrangements to establish an electric light plant here.

Holgate, O.—An electric light plant and waterworks are to be established at this place.

Hot Springs, Ark.—The citizens are agitating the question of erecting a municipal electric light plant.

Independence, Kan.—The council has granted an electric light franchise to I. B. Wallace of this city to put in an electric light plant. The work on its construction will shortly begin.

North Platte, Neb.—This place will soon have a new electric lighting plant.

Ossining, N. Y.—The electric light wires here were badly damaged by the storms of last week.

Paris, Mo.—Plans, specifications and bids for constructing and installing a combined electric light and waterworks plant will be received here until July 22. James T. Moss, clerk, and T. G. Mitchell, mayor.

Port Huron, Mich.—The People's Electric Light & Power Company will ask for a franchise at the meeting of the common council. E. J. Schoolcraft and others are said to be interested in the company.

Sioux Falls, S. D.—The city council is making arrangements to build an electric light plant.

South McAlester, I. T.—The capacity of the electric light plant in this place is to be doubled.

Starkville, Miss —This city has voted to issue $10,000 in bonds to build an electric light plant.

Troy, O.—The board of trustees of the Electric Works have a number of improvements in contemplation which will place the city's electric plant in excellent condition.

Street Railways.

Albany, N. Y.—The Catskill Mountain Traction Company was incorporated last week with a capital stock of $300,000 to operate a street surface railway by electricity from Saugerties to the Otis Elevating Railroad in the town of Catskill. The directors are; Hawkins A. Tucker, Arthur E. Walradt, Gustave S. Dowin, Robert C. McCormick, Joseph N. Keatinge, Charles P. Blaney, Joseph Kelly, Herman F. Lee and G. Louis Meade. The proposed road is expected to shorten the riding time between New York City and the Catskill Mountains by 1¼ hours.

Baltimore, Md.—The United Railways & Electric Company has secured permission to construct additional tracks in the northern suburbs. Wm. A. House is manager.

Binghamton, N. Y.—The citizens are organizing a company to build an electric railroad from this city or Port Dickinson to Chenango Bridge, Lilly Lake, Chenango Forks and probably other points still further north.

Chicago.—One hundred and twenty new cars, each to seat 52 passengers, are to be added at once to the equipment of the Chicago City Railway Company. These cars are of the combination pattern designed by General Manager McCulloch and can be used as open cars in summer and closed in winter. The cost of this new rolling stock under the contract signed by President D. G. Hamilton of the company is $750,000.

Corsicana, Tex.—It is reported that Memphis parties have become interested in the plan to build an electric railway in the city and suburbs.

Covington, Ind.—The Fountain County Electric Railway Company has been incorporated by C. M. McCabe, W. W. Luke, M. Herzog and others.

Everett. Wash.—A fifty-year franchise has been awarded to Mayor Charles K. Greene of this city by the board of county commissioners to construct and maintain an electric line from Lowell to Snohomish.

Ft. Worth, Tex.—The Northern Traction Company of this city has filed an amendment to its charter increasing its capital stock from $500,000 to $1,000,000.

Geneva, N. Y.—An electric road is under contemplation from Geneva to Hall's Corners, thence to Ferguson's Corners, Potter Center, Italy Hill and Prattsburg.

Herkimer, N. Y.—It is stated that an electric line is to be built between here and Little Falls.

Huntington, N. Y.—A new motor freight car was added to the equipment of the Huntington Electric Railroad last week. It obviates the necessity of hauling or pushing freight cars behind or in front of the passenger cars, as has been done in the past. It also enables the employes to handle the freight independently of the regularly scheduled passenger trips. It is regarded as a measure of safety as well as convenience and is hailed by the public as a genuine improvement.

Kewaunee, Wis.—Thomas Higgins will soon ask the city for a franchise for an electric street railway. As soon as this is granted a line will be extended here from Two Rivers by the way of Mishicot, Tisch Mills and Norman.

Logansport, Ind.—The directors of the Logansport, Rochester & Northern Traction Company propose to build an electric road from this city to Kendallsville, Ind.

Manchester, N. H.—It has been practically decided that Cavanaugh Brothers of this city will build the new Manchester and Haverhill trolley line.

Mount Carmel, Ill.—Secretary of State Rose has recently issued articles of incorporation to the Olney, Lancaster and Mount Carmel Electric Railroad Company, with its principal office located here, and a capital stock of $50,000. Robert Parkinson and M. H. Mundy, Mount Carmel; J. C. Couch, Friendsville; Charles J. Siebert, Lancaster; J. J. Bunting, Berryville; Aden Knoph and William Bower, Olney, are the first board of directors.

Onancock, Va.—Arrangements are practically complete for the establishment of an electric line between here and Accomac Court House. The company has a capital stock of $100,000.

Parkersburg, W. Va.—The city council has granted a franchise to the Parkersburg Industrial Company to build a trolley line in this city and to several small suburban towns.

Princeton, N. J.—The Johnson trolley road is now being pushed forward rapidly on the north side of Princeton.

Rayne, La.—A company is being organized to operate an electric railway between Crowley and this place, a distance of six miles. Dr. W. C. Webb of Rayne is interested.

San Francisco, Cal.—The Market Street Railway Company, the owner of most of the street car lines of this city, is to have a new electric power house.

Toledo, O.—Articles of incorporation were filed last week with the Secretary of State for the Toledo Railroad & Lighting Company, capitalized at $12,000,000. The new company, it is understood, will control the lighting and street railway plants of Toledo.

Tubbsville, O.—There are some prospects of a new electric line being constructed in this place.

Vallejo, Cal.—J. W. and H. F. Hartzell have petitioned the city trustees for a franchise for a street railway to be run by electricity for the carrying of passengers and freight. It is the intention to extend the road to Benicia.

Wabash, Ind.—Articles of incorporation have been filed by the Wabash & Rochester Railway Company, proposing an electric line 33 miles long between these two terminals. The capital stock is $50,000.

Manufacturing.

St. Paul, Minn.—The Imperial Manufacturing Company of this city has been incorporated by George R. Kibbe, Mark D. Flower, Michael P. Ryan, John W. Shepard and James C. Michael. The capital stock is $500,000. The company will manufacture electrical machinery and steam heating appliances.

Terre Haute, Ind.—The Terre Haute Electric Company has recently placed an order, through its consulting engineers, Stone & Webster of Boston, for one 900 hp. cross compound Lane & Bodley engine, to which will be directly connected a 600 kilowatt Westinghouse two-phase alternator.

Warren, O.—Warren men have formed the Sterling Electrical Manufacturing Company, with a capital of $50,000, and will probably build a plant in this city, though Jamestown, N. Y., Niles and Lorain offer bonuses. The men interested are W. A. Smith, F. B. Wadsworth, C. G. Dennison, G. C. Webster and F. A. Milliken.

Company Matters.

Baltimore, Md.—The Hoen Building in this city was destroyed by fire July 4, and among the firms that suffered loss was the Southern Electric Company.

Middletown, Conn.—The Farmington River Power Company has voted to increase its capital $25,000 by increasing the number of shares from 5,000 to 6,000, making the total capital $150,000.

New Orleans, La.—The consolidation of the Carrollton Street Car Company, the Edison Electric Company and the Merchants' Electric Light Company of this city, with a combined capital of $7,500,000, has been completed.

Sioux City, Ia. –The Sioux City Gas Company and the Sioux City Electric Company have been consolidated under the title of the Sioux City Gas & Electric Company with a capital stock of $1,500,000.

Power and Transmission.

Bangor, Me.—The Messalonskee Electric Company has purchased the Rice Rips water power, and will erect a large wooden dam during the summer.

Los Angeles, Cal.—The largest electric power project yet introduced in Southern California is that of the California Power Company, now planning to develop power from the Kern River in four places, the total power to be developed being estimated at 60,000 hp. delivered in this city, something more than a hundred miles from the point of development.

New Rochelle, N. Y.—The Westchester Lighting Company, which a short time ago combined all the electric and gas plants in Westchester County, is just completing an establishment in New Rochelle, from which it will transmit electricity to all parts of the county.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Albany, N. Y.–July 9						
United Traction	100	$5,000,000	$5,000,000	1½ % Q.,	106	108
(Consolidation of the Albany and Troy City Railway.)						
Allentown Pa.–July 9						
Allentown & Lehigh Val. Trac. Co		4,000,000	1,500,000	....	--	15
Bridgeport, Conn–July 9:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug.,	100	...
Baltimore Md–July 9						
a United Rail ways & Elec. Co...com	50	24,000,000	18,000,000	....	17	17¼
Boston, Mass.–July 9						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15,	...	..
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	15	16
North Shore Traction Co.........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	85	87
b West End Street Ry. Co.......com.	50	10,000,000	[illegible]	3½ % S., Oct.,	95	95¼
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Jan.	114	115
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 99,	179	181
Brooklyn N. Y.–July 9:						
Brooklyn City Ry	100	2,000,000	1,928,400	....	245	250
Brooklyn Rap. Transit Co., tr certif..	100	48,000,000	48,000,000	....	74½	75
cBrooklyn Heights Railroad	....	200,000	200,000	....	107	109
* dBrooklyn City RR.........guar	100	12,000,000	12,000,000	3½ % Q., Jan.,	237	239
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	2,000,000	1,884,200	2½ % Nov.,	325	330
Kings County Elevated	....	4,750,000	4,750,000	....	..	...
Kings County Traction Co	100	4,500,000	4,500,000	1 % July	..	..
Nassau Electric Railroad ....pfd.	......	6,000,000	6,000,000	....	82	83
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad..	....	1,000,000	1,000,000	....	..	..
Buffalo N. Y.–July 9:						
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	....	74	75
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec.	99	100
Columbus O.–July 9						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb.	38	39
Columbus Street Railroad, pfd ...	100	1,500,000	1,500,000	....	100	102
Charleston, S. C.–July 9						
Charleston City Ry. Co	50	100,000	100,000	3 % S.	--	--
Enterprise City RR. Co	25	1,000,000	250,000	....	--	--
Chicago, Ill.–July 9						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31,	250	260
Chicago & South Side R. T. RR....	100	10,828,800	10,828,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	......	13¾	14
Metropolitan West Side Elev. Ry...	100	15,000,000	7,000,000	Feb 28 1900.	34½	35
Met. West Side El., pfd	100	15,000,000	9,000,000	....	92	92¼
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan.	209	210
hNorth Chicago City RR	100	500,000	249,900	....	200	201
South Chicago City Railway	100	2,000,000	1,608,200	....	108	109
West Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Feb.	103	103½
Union Traction Ry.. .... com	...	1,250,000	624,900	35 %	18½	18¾
Union Traction Co. .... pref.	100	2,000,000	2,000,000	5 % S.	59	59¼
Cincinnati, Ohio.–July 9.						
Cincinnati Inc. Plane Ry.......com	50	1,000,000	575,000	....	..	..
Cincinnati Inc. Plane Ry........pfd	50	150,000	150,000	½ % Feb.	..	..
Cincinnati, Newport & Cov. St. Ry	100	8,000,000	8,500,000	2½ % Feb.	75	76
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan.	124½	125
Mt. Adams & Eden Park Inc. Ry	50	2,500,000	2,200,000	1¼ % Q., Jan.	126½	127
Cleveland, Ohio–July 9.						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¼ % Jan.	48	50
Cleveland City Ry	100	8,000,000	7,600,000	3-5 % Jan.	100	102
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct.,	80	81
Detroit, Mich.–July 9						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	....	1,200,000	....	175	..
Rapid Railway Co	...	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.–July 9						
City Railway Co..............com	100	1,500,000	1,470,600	1¼ % Q.	140	145
City Railway Co...............pf	100	600,000	600,000	1½ % Q.	170	..
People's Street Railway		1,100,000	1,100,000	....	114	115

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Hartford Conn.–July 9						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Oct.,	150	–
Hartford & West Hartford	100	1,000,000	247,000	....	--	–
Holyoke Mass.–July 9						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., June,	207½	212
Hoboken N. J.–July 9						
North Hudson Co. (N. J.) Ry. Co...	25	1,250,000	1,000,000	8 %,	150	–
Indianapolis, Ind–July 9						
**Indianapolis Street Ry	....	5,000,000	5,000,000	....	25	25½
Lancaster, Pa.–July 9						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	--	–
Lancaster & Col. Electric Ry	....	....	87,500	....	--	–
West End Street Railway	....	....	....	....	--	–
Louisville, Ky.–July 9:						
Louisville Ry.................com	100	4,000,000	3,500,000	1¼ %., April.	82	83
Louisville Ry.................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1,	112	113
Minneapolis, Minn.–July 9						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	89	89¼
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,712,200	1¾ %, Oct.	186	187
Montreal, Canada.–July 9						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	279	280
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	109¾	110½
Memphis Tenn.–July 9						
Memphis Street Railway Co	100	500,000	500,000	....	25	–
New Haven, Conn.–July 9:						
Fair Haven & Westville RR	25	2,000,000	2,000,000	8 % S., Sept.	39	41
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July	...	...
New Haven & Centerville	100	700,000	800,000	....	..	–
Winchester Avenue RR	25	1,000,000	600,000	....	45	46
New Orleans, La.–July 9						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., July,	..	..
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Oct.	148½	153
New Orleans Traction Co new com.	100	....	....	....	22½	24
New Orleans Traction Co new pfd.	100	....	....	....	95	98
aCrescent City RR.............guar.	100	2,000,000	2,000,000	8 % S., Jan.,	20½	26
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan.,	..	..
Orleans Railroad	50	500,000	185,000	1½ %., June,	..	52
St. Charles Street Railway	50	1,000,000	1,000,000	1¼ %. Oct.,	56½	57
New York–July 9						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	260
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Oct.,	175	185
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Nov.	120	185
dMetropolitan Street Ry. Co	100	45,000,000	45,000,000	2½ % Q., Feb., 1901.	169	169½
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July,	85	87
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	240	245
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	205	210
hEighth Avenue RR	100	1,000,000	1,000,000	....	400	405
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	392	402
jNinth Avenue RR...........guar.	100	800,000	800,000	....	198	200
kSixth Avenue RR...........guar	100	2,000,000	2,[illegible],000	....	208	210
lTwenty-third St. R. R. Co..guar.	100	600,000	6[illegible],000	4½ % Q.	400	410
Second Avenue RR	100	2,500,000	1,8[illegible],000	2 % Q., Jan.,	210	212
Third Avenue RR	100	12,000,000	10,0[illegible] 000	$1.75 p. sh. Feb.	120½	120¾
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,50[illegible] 000	....	65	75
*Union (Huckleberry) Ry	100	2,000,000	2,00[illegible] 000	....	190	200
Newark N. J. July 9						
Consolidated Traction Co of N. J...	100	15,000,000	[illegible],000,000	....	67½	68½
North Jersey Railway Co	100	6,000,000	[illegible]000,000	....	25	26
United Elec. Co. of New Jersey..	100	504,000	504,000	11¼ % A.	283½	284
Pittsburg, Pa.–July 9						
Allegheny Traction Co	50	500,000		....	27	28
oConsolidated Traction Co....com.	50	15,000,000		2 %, Jan.	22¾	23
Consolidated Traction Co......pfd.	50	9,478,850		3 %, Nov.	62⅓	63
pCentral Traction Co	50	1,500,000		1½ % Nov.	78¼	78¼
qCitizens' Traction Co	50	3,000,000		5 % A.	72¼	72½
rDuquesne Traction Co	50	3,000,000		5 % A.	..	...
sPittsburg Traction Co	50	2,500,000		3½ %, Nov.	⅓	..
Federal St. & Pleasant Valley Ry..	25	1,400,000		2½ %, July,	27	29
Pgh., Allegheny & Man. Trac. Co....	50	3,000,000		2 %, Aug.	..	..
Pittsburg & Birmingham Trac. Ry..	25	1,500,000		1 %, Oct.	41	42½
Pittsburg & West End Ry	50	3,000,000		5 % A., June	..	..
United Traction Co.................com.	50	17,000,000		J. & J.	13¼	18½
United Traction Co.................pref	50	3,000,000		J. & J.	51½	52

* Unlisted. ‡ Ex div.

a The United Railways & Electric Company comprises in its organization the Baltimore Consolidated Railway Company, the Baltimore City Passenger Railway Company, all the lines of street railway operated by these companies, and also the Central Railway Co of Baltimore. The pref stock of U R & Elec Co has been issued in the form of income bonds.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranted by West Chicago Street Railway Company, lessee.

l Cincinnati St. Railway purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‖ Outstanding. ‡ Ex-div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Ry. at 8 % on stock until Oct. 1, 1897; thereafter 9 %.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1895, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter.

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 % on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens' Duquesne, Fort Pitt & Pitt'b Traction.

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock.

s Leased to Consolidated Traction Company for 7 % on capital stock.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
New Bedford Mass.—July 9						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb.	160	165
Northampton, Mass—July 9						
Northampton Street Ry	100	800,000	225,000	4 % A., June.	170	178
Omaha, Neb.—July 9						
Omaha Street Ry	100	5,000,000	5,000,000	3 % A. and N.	55	65
Paterson N. J.—July 9						
Paterson Ry. Co.	100	1,250,000	1,250,000	....	54	--
Providence, R. I.—July 9						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Oct.	109	110
Philadelphia.—July 9						
Fairmount Park Transp. Co...$50 pd.	50	2,000,000	1,770,000	2 %, Dec.	23	24
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15,	47	48
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	588,900	‡588,900	3 % S—July,	75	76
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1,	27½	28
Union Traction Co....$12½ pd	50	30,000 000	29,980,450	....	30	30½
cElectric Traction Co	50	....	8,297,920	....	--	...
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	345	--
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.	450	451
fLehigh Avenue Ry. Co	50	1,000,000	....	....	48	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	90	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar.	300	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April,	...	--
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—	150	151
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan.,	151	152
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	....	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh. Oct.	95	95¼
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar.,	...	--
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July	158	157
jEmpire Passenger Ry. Co	50	600,000	‖600,000	....	...	--
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July	208	208¼
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$8.50 share July	100	--
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July	308¾	309
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July,	...	--
j17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July,	--	--
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖885,000	$11 sh. A., July,	300	--
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July	239	240
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July	262	263
Rochester, N. Y.—July 9						
Rochester Railway Co	100	5,000,000	5,000,000	....	25	28
Reading, Pa.—Junly 9						
jReading Traction Co	--	1,000,000	1,000,000	Semi-an., Jan. & Jy	24	26
kCity Passenger Ry	50	850,000	850,000	Jan.,	138	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan.,	70	--
St. Louis Mo.—July 9						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	--	--
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec.	--	--
Lindell Ry	100	2,500,000	2,400,000	1¼ % Jan.	--	--
National Railway Co	--	2,500,000	2,479,000	1½ % Jan.	--	--
Cass Avenue & Fair Grounds	--	2,500,000	2,500,000	....	--	--
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct.,	--	--
St. Louis RR	100	2,000,000	2,000,000	2½ %, Jan.,	...	--
Missouri RR	50	2,400,000	2,300,000	1½ % Jan.,	--	--
People's RR. Co	50	1,000,000	800,000	50c., Dec.,	--	...
United Electric Ry....com.	50	500,000	500,000	....	24	25
United Electric Ry....5 % pref.	100	1,000,000	1,000,000	3 %, Jan.,	78¼	79
St. Louis & Suburban Ry	100	3,000,000	2,500,000	....	90	93
Union Depot RR	100	4,000,000	4,000,000	3 % A., July,	--	--
San Francisco, Cal.—July						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	117	119
Geary Street Park & Ocean RR	100	1,000,000	375,000	$2.50 share,	50	--
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	61½	68⅛
Presidio & Ferries RR	100	1,000,000	550,000	....	--	16
Scranton Pa—July 9						
Scranton Railway Co	50	6,000,000	2,500,000	....	29	30
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	16½	...
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	--	--
Springfield Ill.—July 9						
Springfield Consolidated Ry	100	750,000	750,000	....	--	--
Springfield O.—July 9						
Springfield Street Ry	100	1,000,000	1,000,000	....	--	11
Springfield, Mass.—July 9						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	207	212
Toronto Canada.—July 9						
Toronto Street Ry	100	6,000,000	6,000,000	1¾ % S.	109¼	110½
Montreal Street Railway Co	.....	4,000,000	4,000,000	4 % S.	279	280
Washington, D. C.—July 9						
Belt Ry. Co	50	500,000	500,000	....	--	--
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct.	103⅝	103⅞
Columbia Ry. Co	50	400,000	400,000	6 % A.	--	...
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	35	40
Georgetown & Tenallytown Ry	50	200,000	200,000	....	20	21
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	--	--
Worcester, Mass.—July 9						
*Worcester Traction Co....com.	100	3,000,000	3,000,000	....	32¼	35
*Worcester Traction Co....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb.,	107	108
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %,	...	85
Wilkesbarre, Pa.—July 9						
Wilkesbarr & Wyoming Val Trac.	100	5,000,000	5,000,000	1%, Jan.,	25	26

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* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex-div.

a Leased to Hestonville, Man & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Company at a rental of $10,000 per annum in 1866-7-8, p. a. $20,000 in 1899-1900 and $30 000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6 % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Co., formerly Scranton Traction Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Boston, Mass.—July 9						
American Tel & Tel Co	100	50,000,000	22,650,000	4½ % Q., Jan.	155½	155¾
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Feb. 20,	50	50½
New England Telephone Co	--	10,394,600	10,304,600	$1.50 p. sh. Feb	141	141
New York.—July 9						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	91	94
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	100	105
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	173	175
Franklin Teleg. Co.....2½ % guar.	100	1,000,000	......	1¼ % S.	42	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Feb.,	--	--
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	108	109
*International Ocean Tel Co.guar 6 %	100	3,000,000	......	1½ % Q.	116	118
Mexican Telephone Co	100	2,000,000	......		3	3⅛
*New York & New Jersey Tel. Co	100	5,000,000	3,723,000	2½ % Q., Jan.,	168	178
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	70	75
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	--	.
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	95	100
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan.,	115	
Western Union Telegraph Co	--	......	97,370,000	1¼ %, Q, Jan.	91	91¼
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—July 9.						
American Dist. Teleg. (Phila.)	25	400,000	.....	1 % Q.	26	37
Bell Teleph. Co. (of Canada.)	100	3,960,000	3,561,000	2 % S.	188	--
Chesapeake & Potomac Telep. Co	100	......	......	....	67	70
Chicago Telephone Co	100	......	......	......	200	210
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	148	150
Empire & Bay States Telegraph Co.	...	......	......	....	75	76
Hudson River Telephone Co	109	2,000,000	2,000,000	1 % Q.	120	125
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	122	125
Providence (R. I.) Teleph. Co	50	......	......	....	96	99
Southern New Eng. Teleph. Co	100	3,000,000	......	....	...	--

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—July 9						
Fort Wayne Electric trust receipts	--	......	......	....	115	125
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	15	25
†General Electric Co. [old]... com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	--	--
General Electric Co. [new]...... "	100	18,276,000	18,276,000	1½ % Q., Apr., 1901	260	260¼
T.-H. Elec. Co..T. Secur., Series C.	--	......	......	....	22	23
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	70	70¼
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q., Jan.,	75¾	76
Westinghouse El. & Mfg. Co. rights.	50	11,000,000	8,195,126	......	1¾	1⅞
New York.—July 9						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,938,000	....	119	120
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	2,000,000	1½ % Oct., '98.	--	--
Edison Ore Milling Co	100	......	......	....	8	12
Electric Vehicle Co.....com.	--	......	......	....	--	--
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	--	...
General Electric Co. [new].... "	100	18,276,000	18,276,000	1½ % Q., Apr., 1901	260	260¼
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	--
‖Kings Co. El. L. & P. Co.	100	2,500,000	2,500,0 00	A. & O.	110	125
Pittsburg, Pa—July 9						
Allegheny County Light Co	100	500,000	500,000	J. & J.	168	172
East End Electric Light Co	50	300,000	300,000	Q	--	--
Philadelphia, Pa.—July 9						
Edison Electric Light Co	100	2,000,000	......	......	144	144½
*Electric Storage Battery Co..com.	100	8,500,000	......	......	82	52½
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	85	86
Northern Elec. Light & Power Co	10	550,000	550,000	......	18	18½
Southern Elec. Light & Power Co	10	187,500	187,500	....	30	--
Miscellaneous.—July 9						
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	47	48
Missouri-Edison (St. Louis)....com.	--	......	......	....	20	21
Eddy Electric Mfg. Co	25	......	......	....	9	12
Hartford (Conn.) Elec. Light Co	100	350,000	......	....	190	191
Hartford (Conn.) Lt. & Power Co	25	175,000	......	....	6	10
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	195	--
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct.,	102	104
Rhode Island Elec. Protec. Co	100	......	......	....	118½	120½
Royal Elec. Co. (Montreal)	--	1,000,000	.....	2 % Q	‡250	251
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	136	138
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1,	--	100
Woonsocket (R. I.) Electric Co	100	......	......	....	105	106

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

‖ Recently acquired the Edison Illuminating Co. of Brooklyn and its constituent company, the Municipal Electric Light Co.

ALLIED INDUSTRIES.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—July 9						
American Electric Heating Co	50	10,000,000	....	.....	--	--
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh.	--	--
United Electric Securities Co...pfd.	100	......	1,000,000	$3.50 p.sh.	--	100
New York.—July 9.						
Consolidated Electric Storage Co	...	......	....	....	8	12
Safety Car Heating & Lighting Co	100	......	....	......	150	155
Worthington Pump Co.....com.	100	5,500,000	5,500,000	......	--	--
Worthington Pump Co.....pfd	100	2,000,000	2,000,000	7 % A	113	114
Philadelphia Pa.—July 9						
Electro Pneumatic Trans. Co	10	1,500,000	......	--	2	2½
United Gas Improvement Co..scrip.	50	10,000,000	......	--	--	162
Welsbach Commercial Co.....com.	100	3,500,000	......	--	20½	21½
Welsbach Commercial Co.....pfd.	100	500,000	......	2 % Q	73	75
Welsbach Light Co	5	525,100	......	....	54	55
Welsbach Light Co., Canada	5	500,000	......	....	1	1½
Pittsburg, Pa.—July 9						
Carborundum Mfg. Co	100	200,000	200,000	....		
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	224	225
Miscellaneous.—July 9						
*Barney & Smith Car Co.....com.	100	......	1,000,000	--	20	25
*Barney & Smith Car Co.....pfd.	100	......	500,000	2 %	120	129
Billings & Spencer Co	25	......	....	....	32	
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb	50	55
Johns-Pratt Co	100	....	....	--	105	109
Pratt & Whitney Co.....com.	100	......	....	--	--	
Pratt & Whitney Co.....pfd	100	....	......	--	85	90
Stillwell-Bierce Co.....com.	--	....	....	--	--	50
Stillwell-Bierce Co.....pfd.	--	....	....	2 % Sept	65	70
Shultz Belting Co	100	500,000	....	....	80	90
St. Charles Car Co		....	....	......	89	84

*Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany N. Y.

Date of Quotation—July 9, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry. Co......Cons. mtg. 5s	$500,000	427,500	1940	J. & J.	117⅛	......
†The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*116⅛	......
‡Watervliet Turnpike & RR. 1st mtg. 6s	350,000	350,000	1919	M. & N.	*125	....
‡Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*124	126
Troy City Railway Co....................1st 5s	....	....	1942	......	*116	117

†Interest guar. by Albany Ry. Co.
‡Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—July 9, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
United Electric Ry. Co...1st mtg. g. 4s	38,000,000	18,000,000	1949	M. & S.	102	102¾
" " " ....income 4s.	14,000,000	....	1949	J. & D.	74¾	75
Baltimore City Pass. Ry..1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	118⅞	....
†Baltimore Traction Co......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	119	120
†Baltimore Trac. Co. Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	104⅛	......
†Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	121	121⅛
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	101	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	102⅛	......
†Central Pass. Ry. Co.........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
†Central Pass. Ry. Co..Cons. mtg. g. 5s	604,000	580,000	1932	M. & N.	119	121
†City & Suburban Ry.....1st mtg. g 5s	3,000,000	3,000,000	1922	J. & D.	116	117
†Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	117	......

☞ All of the bonds of the above companies, marked †, have been assumed by the United Railways & Electric Company.

Boston Mass.

Date of Quotation—July 9 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	114	115
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104⅛	106
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S	112	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—July 9, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	.. .	....
†Charleston City Ry.......... 1st mtg. 6s.	350,000	....	....	J. & J.	106	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—July 9, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry..............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¾	2¾
†Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.................4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	108⅛	109
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	96	96⅛
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	106	......
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	......
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	......
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	108	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	......	111
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	101	102
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	106⅝	107
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	....	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co

Cincinnati O.

Date of Quotation—July 9, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	114⅛	115
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103⅛	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	114	......
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	581,000	581,000	1906	M. & S.	108¾	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	121⅛	122⅛
‡So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	132¾	137

† Assumed by the Cincin. St. Ry. Co.
‡$250,000 reserved to retire 1st mtg. bds.

Cleveland O.

Date of Quotation - July 8, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S.	106½	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	113½	114½
Cleveland City Cable Ry.....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	105½	106
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	106	107
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
aEast Cleveland RR...........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	......	107½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—July 9, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,885,000	1905	A. & O.	......	102½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry.................1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	105	106½

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—July 9, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918		111	....
New Haven (Edgewood Div.) 1st. mtg. 5s.	250,000	250,000	1914	J & D	111	......
Winchester Avenue RR—1st mtg. g. 5s.	190,000	500,000	1912	M& N	109	......
Winchester Avenue RR......Deben. g	100,000	94,000	1919	M& S		

New Orleans La.

Date of Quotation—July 9 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR... cons mtg. 6s.	$150,000	$150,000	1912	M. & N.	......	....
Crescent City RR.............1st mtg. 6s.	....	50,000	1899	M. & N.	105⅛	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1948	J. & J.	......	.....
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1908	J. & D.	108	112
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1948	J. & J.	112	113
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	......
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	......	......
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	......	......

†$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York

Date of Quotation—July 9 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	......
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107⅛	110
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	115	116
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	123	125
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	105⅛
Broadway & 7th Ave.........2d mtg. 5s.	500,000	500,000	1914	J. & J.	108	110
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	115	116
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	101	....
Brooklyn Heights RR.......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	......
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	112	....
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	107	....
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	108⅛	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	98⅛	100⅛
Cent P'k, N. & E. R. RR. 1st cons. mtg. 4s.	1,200,000	1,200,000	1902	J. & D.	107	109
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	125	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	101	108
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1932	J. & D.	117	120
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	100,000	1,100,000	1914	F. & A.	102	105
Eighth Av. RR. Co.....Cert. indebt. 6 %.	000 000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	,200,000	1,200,000	1910	M. & S.	116⅛	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	89	......
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	124	125
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	120	......
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600 000	1909	M. & N.	120	121
Second Avenue Ry..............Deb. 5s.	800,000	800,000	1909	J. & J.	108⅛	109
Steinway Ry. (L. I.).........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	116	117
South Ferry RR. Co............1st mtg. 5s.	850,000	850,000	1919	......	110⅛	112⅛
Third Avenue RR.............1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	......	12[illegible]⅛
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	.....	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	106	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	118	116
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	114

†$1,085,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—July 9 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.......................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.		....
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M & S.		....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—July 9, 19[illegible]

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry.....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	... ..	....	....
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J &	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s.	1,800,000	1,018,000	1917	F. & A.	......	....
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co................Col. tr. 4s.	29,785,000	29,724,876	1945	A. & O.	....	....
West End Passenger Ry....... 1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	......	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	......	......

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg. Pa.

Date of Quotation - July 9 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,000	1931	M. & S.	111⅛	....
Central Traction Co...............1st mtg. 5s.	375,000	375,000	1930	J. & J	......	......
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	......	......
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	110	118
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	113
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co......................5s.	2,500,000	2,009,000	1934	J. & D.	......	......
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1912	M. & S.	......	....

Providence R. I.

Date of Quotation—July 9 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	.....	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	116	118

St. Louis.

Date of Quotation—July 8, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baden & St. Louis RR.........1st mtg. 5s	250,000	250,000	1918	J & J	101⅛	102⅛
Cass Ave. & Fair Gds Ry......1st mtg. 5s	1,813,000	1,813,000	1912	J & J	101⅛	102⅛
Citizens' Railway Co.......1st mtg. 5s	2,000,000	1,500,000	1907	J & J	109	
Temp. Hts. Un. De. & Mer. Ter.—1s *	1 000 000	000 000	191	J& J	17	

* With interest ? Unlisted With interest

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—July 9 1 01						
Jefferson Avenue Ry..........1st mtg. 5s.	270,000	270,000	1905	M. & N.	102	108
Lindell Ry. Co.......................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	108
Missouri RR. Co....	1,000,000	700,000	1916	M. & S.	105	106
‡Mound City RR. Co..............1st mtg. 5s.	400,000	300,000	1910	A. & O.	104½	105½
People's RR. Co.....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	....	......
‖People's RR. Co......................2d mtg. 7s.	75,000	75.000	1902	M. & N.	......	......
People's RR. Co.................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	......	......
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	99½	100½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	3,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry................Income 5s.	300,000	300,000	......	....	80	84
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	106	108
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	300,000	500,000	1913	J. & J.	116½	117½
Union Depot RR. Co....1st cons. mtg. 5s.	1,091,000	1,091,000	1900	A. & O.	100	100½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	121	122
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—June 1901.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	117
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	......	95
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	126½	......
†Metropolitan Ry. Co..................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126½	......
†Park & Cliff House RR.......1st mtg. 6s.	350,000	350,000	1912	J. & J.	105½	107
†Park & Ocean RR.................1st mtg. 6s.	250,000	250.000	1914	J. & J.	115	......
†Powell St. Ry.........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	.....	125
Sutter St. Ry. Co................1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—July 9. 1901						
Belt Ry. Co..........................Cons mtg 5s.	900,000	450,000	1920	J. & J.	......	....
Columbia Ry..............................1st mtg. 6s.	500,000	500,000	1914	A. & O.	122	......
Eckington & Soldiers' Home, 1st mtg. 6s.	900,000	200,000	1911	J. & D.	......	......
Metropolitan RR. Co.....Coll. tr. cons. 6s.	800,000	500,000	1901	J. & J.	......	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation— July 9, 1901						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	108	110
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	118	....
†C'tizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	104	105
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	112	113
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	115	....
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	12,965,000	1933	J. & D.	111¼	111½
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	115	115½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,300,000	1920	J. & J.	20	..
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	85
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,981,000	1930	J. & J.	119	119½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	110½	110½
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	8,000,000	2,878,000	1928	J. & J.	108	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	....	......
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	......	......
St. Paul City Ry.......................Cons. g. 5s.	5,500,000	4,298,000	1937	......	105½	106
St. Paul City Ry.........................Deb. g. 6s.	1,000,000	1,000,000	1900	......	108	....
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. O. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—July 9, 1901.						
Delaware Gas Lt. Co.,..........1st m. 5s, g.	800,000	800,000	......	J. & J.	106	108
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	157	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	116	......
Pittsburg Pa						
Date of Quotation—July 9. 1901						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	110	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(July9 1901.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	109	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1998	......	124	......
Edison Elec. Illg. Co. (Brooklyn).......	5,000,000	5,000,000	1940	....	122½	124
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	. ..	......
Kings Co. El. Lt. & Pow. Co.1st mtg. 5s.	2,500,000	......	1937	A. & O.	100	105
Kings Co. El. Lt. & Po. Co.pur. money 6s	5,176,000	....	1997	A & O.	120	122
Milwaukee El. Ry & Lt. Co.1st con. g. 5s.	8,000,000	....	......	F. & A.	102½	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—July 9 . 1901.					100½	101
American Bell Telephone...................4s.			1908	F. & A.	......	....
NorthwesternTelegraph Co................7s.	....	......	....	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	114	115
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	106

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—July 9 1901.						
American Electric Heating............. 7s	500,000	500,000	....	....	....	......
Armington & Sims Engine Co.............	....	....	......	......	......	25
Barrney & Smith Car Co.......................6s.	....	....	1942	J. & J.	106	107
Carborundum Mfg Co.........................6s.	....	....	1904	J & D.	......	......
Worthington Pump Co........................	75,000	....	......	....	115	127

Unlisted ‡Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 16⅞@17c.; Lake, 17@17⅛c.: casting, 16⅝@16⅞c.

Electric Storage Battery stock advanced in the Philadelphia market last week. Against 52½ a few weeks ago, both common and preferred crossed 87.

The copper market is comparatively quiet. The London market is extremely dull, but consumption of copper by the home trade continues on a large scale.

A Philadelphia Union Traction Company director is reported as saying that the net earnings of that company for the year ended June 30 will be just about $1,000,000.

The Whitehall & Granville (N. Y.) Electric Railroad Company has been granted permission to issue a first mortgage for $400,000 on its new road between Whitehall and Granville.

The Chicago City Railway Company on Monday issued to stockholders the $4,500,000 new stock authorized some time ago, and it is thought the stock of the company will be put out on an 8 per cent. basis, as against 12 per cent. heretofore paid.

The following are quotations for some of the industrial stocks not quoted elsewhere: Electrical Lead Reduction, 3@3½; Electric Boat, 15@17; Electric Vehicle, 9@10; Tel. & Tel. Company of America (full paid), 4@6¼; Electric Company of America, 7@7⅛; National Carbon, 16@18.

It is again reported that the control of Brooklyn Rapid Transit has changed. The Philadelphia contingent in Metropolitan Street Railway have now a very large amount of the stock though perhaps not actual control. Traction experts say the new management of the property is introducing considerable improvement in operating methods.

The stock market in New York Monday suffered the most severe b k in prices it has had on any single day in months, the May panic alone except . A state of semi-demoralization ruled practically all day long, with final figures as a consequence showing net declines of nearly all standard stocks of from 3 to 3 points. General Electric declined 5 points.

The application of the Ballston (N. Y.) Terminal Company, which was presented to the State Board of Railroad Commissioners by Senator E. T. Brackett and W. B. Dunlop, for permission to increase its capital stock from $300,000 to $1,500,000, and to issue a mortgage for $1,200,000 on its property, has been granted. One of the objects of this increase is to permit the company to build twenty miles of new road.

The directors of the Consolidated Traction Company of New Jersey announced on Saturday a regular semi-annual dividend of 1 per cent., payable July 15. The dividend will be paid with the money received from the North Jersey Street Railway Company as rental payment under the terms by which the North Jersey leased the Consolidated Traction Company.

A certificate of merger of the Electric Light & Power Company of Syracuse, N. Y., and the Underground Electric Wire Company with the new Syracuse Lighting Company, was filed recently with the Secretary of State, as well as a certificate extending the business interests of the Syracuse Lighting Company to include the supplying of steam to consumers from a central station to pipes laid in the public streets.

Accompanying the recent upward movement in Massachusetts Electric common have been reports of extensive liquidating by New York parties. It is rumored that good sized blocks of stock that were acquired at the time the company was underwritten have been sold at the recent high prices and that Boston interests have taken up the stock. A member of one of the large trust companies says the price of the stock is altogether too high.

The Conestoga Traction Company, the Lancaster Gas Light & Fuel Company and the Edison Electric Illuminating Company of Lancaster, Pa., valued at about $10,000,000, have passed into the possession of the Lancaster County Railway & Light Company. The power plants of the absorbed companies will be centralized, and $250,000 will be spent in improvements. A $1,000,000 mortgage has been filed by the new company for the issuance of collateral trust bonds, $500,000 to be issued at once.

Relative to the proposed restoration of the capital of the General Electric Company a director and a former member of the executive committee says: "There has been no recent move toward restoring the capital of the General Electric Company to the old amount, but the directors have given considerable attention to the subject and when the plans are fully consummated an announcement will be made to the stockholders. There seems to be a misunderstanding as to the methods to be followed in relation to this increase in stock. While I am not authorized to speak by the card, I can state positively, I think, that there will be no subscription for new stock, but merely a distribution among the stockholders of new stock in proportion to the amount of their holdings. This might properly be referred to as a stock dividend, although in reality it amounts to nothing more than returning to the stockholders what was taken away from them. Whether or not it would be possible to restore at one time the full amount of stock is dependent entirely upon the amount of the company's surplus. A surplus represents in stock actual paid in capital, and if, for instance, the company desired to issue $15,000,000 of new stock, and had a surplus of $7,500,000, stock could not be issued under the laws of the State of New York to an amount in excess of that of the surplus. Any action therefore toward restoring the old capitalization can not be taken until the surplus reaches an amount equal to the par value of the stock to be issued. As to whether or not the present market price of the stock has discounted the proposed increase, I will say that to my mind the price represents the actual intrinsic value of the stock itself in consideration of the earning capacity of the company."

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EDITORIAL NOTES.

Principles of Dynamo Construction.

It is the aim of ELECTRICITY to furnish its readers with articles that will appeal to the practical man and that will tend to help him advance in his chosen profession. A short time ago under the head of "ELECTRICITY'S Educational Series," there appeared a score or more of articles of a practical nature which we have reason to believe met with the approval of our readers, especially the younger element, who were desirous of obtaining information on matters electrical, but who were unable to devote the necessary time to a college course.

In view of the above we propose shortly to run a series of articles entitled the "Principles of Dynamo Construction," which should appeal to young workers in electrical manufacturing establishments.

The new series, as in the case of the one recently drawn to a close, will be as non-mathematical as is compatible with the more or less intricate subjects to be treated. The articles will require for their proper understanding no knowledge of calculus or even algebra, so that there should be no difficulty in a person equipped with an ordinary high school education grasping their meaning.

These articles, which will be illustrated whenever necessary, will we are sure, be read and studied with interest by a large number of our readers.

* * *

The Electrical Equipment of the London Underground.

It goes without saying, comments our London correspondent, that the London public is pretty well tired of the "underground" equipment farce. A few years ago the Metropolitan & District Railways were told, in effect, that if they did not improve the system and adopt electric traction within three years, the line would have to be shut down. It will be remembered that they appointed a joint committee which carried out a short electrical experiment with an idea of ascertaining the best system to adopt. While still experimenting and discussing, the Central London was opened and carried off their traffic to the extent of getting on for $10,000 per week. The committee seemed by the help of its expert advisers to get into a muddle as to what system of electrical working to adopt, and after floundering about sent to investigate the Ganz method. Mr. Yerkes gradually secured large financial holdings in the District, so as to practically control its policy, and the District Board adopted his ideas. But the difficulty then arose as to whether both parts of the railway were to be worked on the Ganz system. Mr. Yerkes has now flatly declared to the Parliamentary Committee that he will not have it for the District line. He stated that his idea was for no particular system but the very best combination of the best American electrical railway practice, although he said he would give English manufacturers the preference in contracts."if they could do things as cheaply and as well as Americans." The two companies are therefore opposed the one to the other as to the system to be used, and that is how the matter now stands. We must add, however, that it is being taken out of their hands to some extent, for the preamble of the District Bill has only been allowed on the condition that if no agreement is arrived at between the two railways within one month, the Board of Trade shall itself appoint an arbitrator who shall hear an engineer state the case for each side of the controversy, and then decide as to the system of working which must be applied. The next development should be a decidedly interesting one.

* * *

The Independent Telephone Movement to be Pushed in the East.

It is acknowledge that the independent telephone movement has progressed far more in the Middle West than it has in the East. Take for instance the State of Ohio—which is admittedly an independent stronghold—and from statistics recently made up, it is seen that Cleveland has 11,000 Bell telephones in use against 7,000 independent instruments. Columbus, the next largest city in the State, boasts of more independent 'phones than Bell instruments, there being 4,642 of the former against 3,300 of the latter. Out of 88 counties in Ohio, the independents had on March 1, 1901, 67,597 telephones in use, whereas the monopoly had but 64,716. Although, as previously stated, Ohio has more independent 'phones than any other State, Illinois and Michigan are not far behind and in each the independents make a most excellent showing.

That the independent telephone movement has so prospered in the Middle West, is undoubtedly due to the untiring and unceasing efforts of several telephone men, notably among them being Mr. James M. Thomas, who has just accepted the presidency of the Telephone, Telegraph & Cable Company of America. Mr. Thomas will hereafter be located in New York City, which means that the independent telephone movement, which has dragged along in this vicinity for several years, will henceforth be pushed vigorously.

The new Interstate Telephone Company has undertaken to cover the New Jersey field and get into Philadelphia with an independent line. In New York it will connect with the Knickerbocker Telephone Company and the latter will co-operate with the Massachusetts Telephone and Telegraph Company to establish a long distance service between this city and Boston.

Referring to this subject Judge Thomas is reported as saying:

"I came here from Cleveland to take charge of the operation and construction of an independent telephone system in New York and Boston. Plans are also being laid for the construction of a long distance trunk line between the two cities. It is the intention of the Telephone, Telegraph and Cable Company to pursue an aggressive policy in the East, where the independent telephone movement has been practically neglected. The construction of a system in New York and Boston will cost about $9,000,000."

President Thomas added that the franchises for operating an independent telephone system in this city and Boston were already in possession of the Massachusetts Company and the Knickerbocker Company, which is now laying wires in certain parts of this city.

Thus it will be seen that a telephone war to the death is declared and that the Independents propose to grapple with the Bell in its heretofore impregnable stronghold.

* * *

Electricity in the Textile Industry.

The projectors of the South Carolina Interstate and West Indian Exposition, when first considering the question of what main buildings should be provided for, and what one should be considered one of the most important buildings of the Exposition, in which could be best shown to the country at large the great developments of the South in the last quarter of the nineteenth century and the immense possibilities of the future, decided that the "Cotton Palace" was the building in which this could best be accomplished. The Cotton Palace will be a magnificent building in the Spanish renaissance style of architecture, with a facade of over 450 feet and a central dome rising to a height of over 150 feet, and having a floor space of 50,000 square feet. In this palace King Cotton will reign supreme. The fleecy staple received at the eastern entrance direct from the farm will pass on through all the varied processes of manufacture until in its westward march it reaches the stage of the completed fabric. All the principal processes of weaving knitting and manufacturing of cotton, hemp, jute and other fibers, will be illustrated and operated in full view of visitors. Electricity will be the motive power and the looms and other machinery will be belted up direct. This feature of the Exposition will enable manufacturers of electrical machinery to demonstrate the great utility of their machines for use in the textile industry—an industry that is making enormous strides throughout the South

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

It is reported that the Antwerp Steel Works of Antwerp, Belgium, has decided to equip its plant with electricity.

Thomas A. Edison's new invention, the thermopile, will be shipped to the Pan-American Exposition the latter part of this month. General Manager Gilmore, of the Edison laboratories, says the thermopile is expected to revolutionize the method of producing electric power. It generates electric power direct from heat, and, fastened to an ordinary Rochester burner, will develop, so it is claimed, five volts and twenty-three amperes of electricity.

Sunday night the electric lights at Zanesville, O, were completely smothered by the ashes of burned June bugs that filled the globes in countless numbers.

The Navy Department is considering the advisability of fitting the Monongahela out in some such manner as the training ship Alliance. A large boiler would then be put in with condensers and evaporators, and the ship would be supplied with electric lights and a refrigerating plant. The Alliance is the only training ship in the navy which is fitted out with such modern conveniences. The cost would be about $30,000 to $40,000.

The German postal authorities, having experimented for a year in Berlin with the American automatic telephone system, have just decided so establish this system permanently.

According to the statement of the water lot owners at the Chaudiere Falls, Ottawa, within probably two years all that will be left of the great falls that Champlain loved, that the Indians worshipped, and that now light and furnish power for the capital of the Dominion, will be a black and yawning gorge of rock. It is proposed to turn every drop of water that passes over the Chaudiere to industrial uses. The new power canals that the Ottawa Power Company has asked permission to build will take a great deal of the surplus water, while other projected improvements and works, it is expected, will absorb all that remains.

The twenty-first annual reunion of the Old Time Telegraphers' Association will take place in Montreal on September 11, 12 and 13 next. At a recent meeting of the executive committee arrangements were made for the entertainment of the guests. Between 300 and 400 are expected. The Association is largely made up of ex-telegraphers, and Senators, Members of Parliament and steel kings are in the Association. Carnegie and Edison are also members. Accompanying the old timers will be a large delegation of municipal electricians who will go to Montreal after the close of their convention, which takes place this year at Niagara Falls. Also associated with the old-timers is the United States Military Telegraph Corps, which will be in Montreal in a body. The president of the Association is Mr. L. B. McFarlane, of Montreal; vice-president, Mr. J. E. Hutcheson, of Ottawa.

Attention is called to the fact that under a recent decree of the Belgium Government felt for use in the manufacture of electric accumulators will hereafter come under the classification "various products of industries," dutiable at 5 per cent. ad valorem. Importers must prove to the satisfaction of the customs authorities that the tissues are actually intended for the above use.

A dispatch from St. Johns, N. F., states that steps are being taken by Minister Murphy, Chief of the Department of Marine and Fisheries, of Newfoundland, to demonstrate the absolute necessity of the establishment of the Marconi system of wireless telegraphy to safeguard life and property embarked upon ocean steamers from the dangers of Cape Race and the adjacent coast. With this end in view, Minister Murphy has had a map prepared from the official records, giving the location of the wrecks which have occurred at and around Cape Race for the last forty years.

Senor Eduardo J. Chiapas, a civil engineer of Guantanamo, is reported to be arranging for the erection of a lighting and power plant at Santiago de Cuba. This will comprise 240 arc lights, 6,000 incandescent lights and power to be furnished to small consumers in and about the city. A complete steam plant will be installed, but later the power will be transmitted from the Guaso River water falls, a number of miles distant.

A boy flying a kite played havoc with telephone service in the northern part of Wabash, Ind., last week. The wind carried the kite accross the wires of the telephone company, and the heavy string lodged on the telephone wires and on electric light wires. The current from the latter was diverted to the telephone lines with the result that the cable box and ninety telephones were burned out while the operators at the exchange were badly shocked.

The will of Albert L. Johnson, the railroad promoter, who died at his home at Fort Hamilton on July 2, was filed for probate in the office of the Kings County Surrogate July 12 by Mayor Tom L. Johnson of Cleveland, brother of Mr. Johnson. By the terms of the will Mayor Johnson, who is named as the executor, is to have absolute control of his brother's estate. He is also a large beneficiary by the will. In the affidavit attached to the papers it is stated that Mr. Johnson left no real property in this State and that the value of the personal property, so far as the petitioner knows, is $1,000,000.

Those who have experienced the annoyance of having blueprints discolored and blurred by rain, droppers in mines, and moisture in general, will appreciate a simple and inexpensive method of waterproofing the prints which renders them completely impervious to weather and water, says "Mines and Minerals." The waterproofing medium is refined paraffin, and may be applied by immersing the print in the melted wax, or more conveniently as follows

Immerse in melted paraffin until saturated a number of pieces of an absorbent cloth a foot or more square, and when withdrawn and cooled they are ready for use at any time. To apply to a blueprint, spread one of the saturated cloths on a smooth surface, place the dry print on it with a second waxed cloth on top, and iron with a moderately hot flat-iron. The paper immediately absorbs paraffin until saturated and becomes translucent and highly waterproofed. The lines of the print are intensified by the process, and there is no shrinking or distortion. As the wax is withdrawn from the cloths, more can be added by melting small pieces directly under the hot iron. By immersing the print in a bath of melted paraffin the process is hastened, but the ironing is necessary to remove the surplus wax from the surface, unless the paper is to be directly exposed to the weather and not to be handled. The irons can be heated in most offices by gas or over a lamp, and a supply of saturated cloths obviates the necessity of the bath.

◆

THE probable success of the submarine boat, says an English writer, and in any case the reliance placed upon it by the French Government, has, as was to be expected, resulted in the ~~problem~~ of defeating it being studied with close attention by the British Admiralty, and many experiments have been made and are being ~~made to~~ defeat a submarine attack. I believe, says he, much success attended these so far as the use of electricity for discovering the proximity or a boat under water is concerned, and this having been determined, methods are being adopted for the destruction of such boats whose presence has been detected.

◆

MR. AUSTIN CHAMBERLAIN, in the British House of Commons on Monday last, detailing the progress of the Pacific cable, said that several sectional cable houses had already been constructed and sent out and were being erected at the various landing places. The survey has been satisfactorily completed over 1,500 miles of the proposed route, and the manufacture of cable will begin this week. Mr. Chamberlain added that landing sites had been selected on the coasts of Queensland, New Zealand, Norfolk Island (between New Zealand and New Caledonia) and at Vancouver, and that the Cable Board was satisfied as to the ability of the contractors to complete the work by the end of 1902.

◆

IT is now rumored that the Manhattan Elevated Road in this city will not be equipped with electricity before the coming year.

◆

ADVICES from England state that electricity has not yet been applied to the turret mechanism of British battleships, and that the Government is still satisfied with the results given by hydraulic power in this connection. It is added. however, that electric gun mechanism would be incorporated in some of the war ships now in course of construction for that country.

◆

THE first completed section of London's new electric-tram system, fifteen out of a total of forty miles, with which the metropolis soon will be girdled, was opened last week, carrying passengers along the Uxbridge Road, past Acton, Ealing and Hanwell to Southall. This is the result of a company enterprise at St. Helen's in Lancashire.

THE League of American Automobilists was incorporated July 12 with headquarters in this city. The purposes of the league, as set forth in the certificate of incorporation, are to develop the automobile industry in the United States and Canada; to encourage the manufacture and use of self-propelling machines, and to that end to provide means for league members to acquire and maintain such vehicles, or a right to use them, at a moderate cost; also to maintain club rooms wherever deemed desirable and to encourage the construction of good roads and highway improvements. The directors are William Herbert Smith, William G. Kinney and William J. Howey, all of this city.

◆

THE railroads are now spending millions for safety devices, have perfect signaling systems, in so far as semaphore and interlocking arrangements are concerned, but what the transportation and operating departments are looking for now is a switch so connected by an electric track circuit with the telegraph offices and towers that any attempt to throw it will break the circuit and warn the operators. This device might also be constructed to work automatically, so that in case the switch is moved all semaphores will be set at the danger indication. A Pittsburg, Pa., electrican is now at work on such a device and claims that it will enable the railroads to save thousands of dollars every week. He will have his circuit so arranged that a broken rail, displaced switch or an obstruction on the track will set all blocks at danger and the traffic will be practically suspended until the defect is removed. At present the fast trains rushing over the road are liable at any moment to be wrecked by an open switch. The signal may be all clear but the next switch around a curve open and then nothing can save the train. When the open switch sets all the blocks at the danger indication, the villainous trainwreckers will be foiled and the railroads much safer than at present.

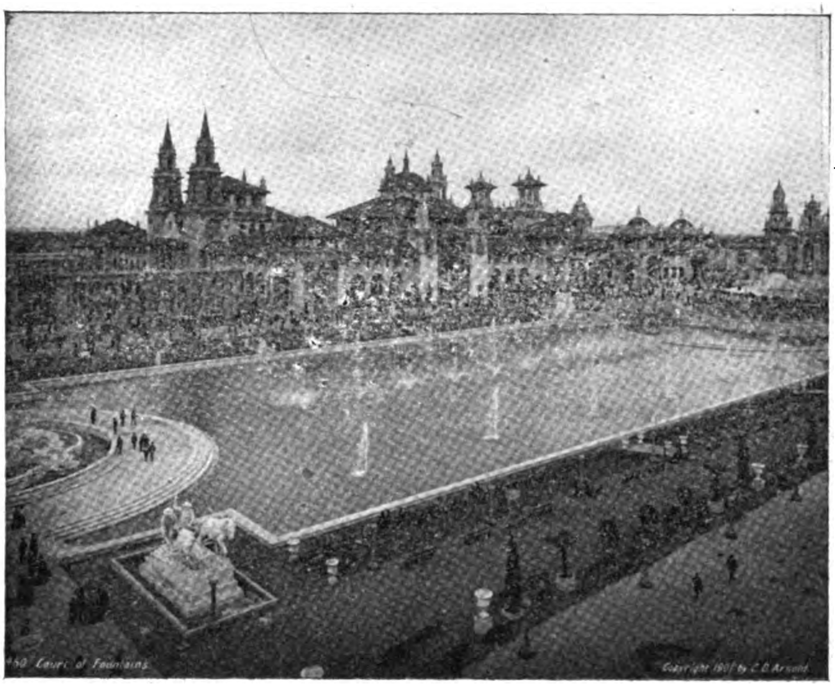

FIG. 1.—COURT OF FOUNTAIN AT THE PAN-AMERICAN EXPOSITION.

◆

THE Goodrich Line, in Chicago, has put into service a telephone connection with steamers lying at the wharf. A telephone instrument in the main saloon is connected with the system of the Chicago Telephone Company and enables passengers on the steamer before she leaves the dock to call up friends in any part of the city. This is the first service of the kind that has been arranged in Chicago. It is probable arrangements will be made so that steamers will be attached to the Milwaukee telephone system when lying in that city.

PAN-AMERICAN SCENES AND EXHIBITS.—I.

BY FRANK C. PERKINS.

Electricity is used so extensively at the Pan-American Exposition and there are so many scenes, both at night and day, which are particularly interesting to readers of ELECTRICITY, that it would be useless to try to describe or illustrate even a small part in a single article. The following series of short articles will give a few glimpses of the exposition, including each week a day view, a night view of one or more of the buildings, or other interesting features, together with an exhibit or two of more or less interest.

The accompanying illustration, Fig. 1, shows the Court of Fountain, and the Machinery and Transportation Building, and Electricity Building are to be seen in the background; the Fountain of Abundance is partially shown at the left and a part of the Fountain basin in front of the Electric Tower at the right. The night scene, shown in illustration Fig. 2, includes the East Pergola, Machinery Building, Temple of Music, Electric Tower and the reflection in the artificial mirror lake. The effect of turning on these thousands of lights very slowly is most pleasing and wonderful. There are more than a quarter of a million lamps used in the decorative effects at the Exposition. The gradually bringing up to candle power is accomplished by a water rheostat in the high voltage circuits, and the methods employed are particularly interesting as the control of such a large amount of energy in this way has never before been attempted. This enormous rheostat boils vehemently before the lamps reach their full brilliancy. It is located on the western part of the grounds and operates on the 11,000 volt line, which supplies the current to the step down transformers in the Electricity Building in the General Electric exhibit.

The 22,000 volt current from Niagara is reduced in tension at the Ontario Street sub-station to 11,000 volts and conducted to the Pan-American through two-three-phase circuits of No. 00 copper on imperial porcelain insulators. The rheostat tanks are 10 feet long, 3 feet wide and 3 feet deep, and they are well insulated with porcelain. The resistance is varied by three cast-iron plates of triangular shape, 8 feet long and nearly an inch in thickness. The plates gradually increase in depth in the water until the ends strike a short-circuiting jaw, completely closing the circuit and cutting out the rheostat, when the lamps have reached full candle power. A worm gear, operated by an electric motor, operates the plates very slowly, giving a most artistic lighting effect to the decorative illumination.

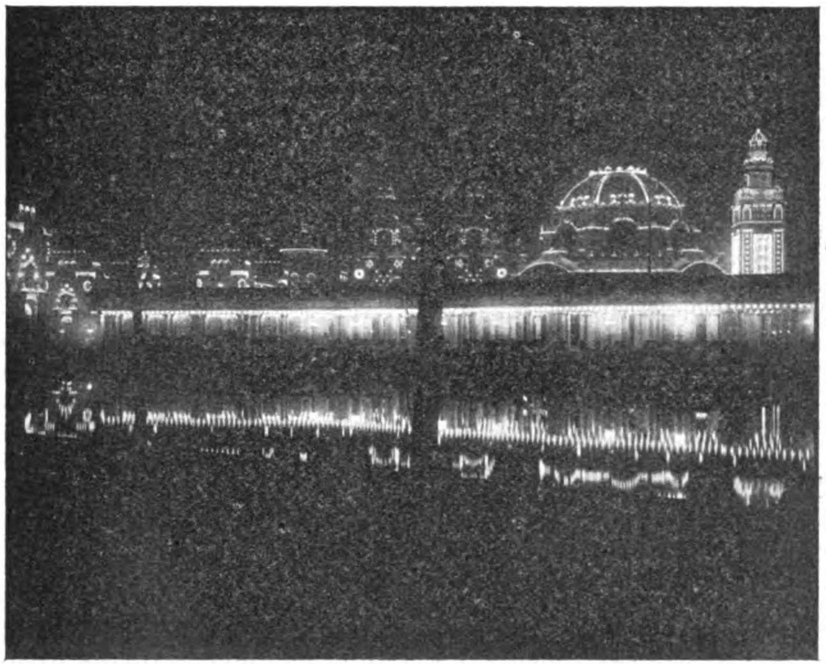

FIG. 2.—PAN-AMERICAN EXPOSITION.
East Pergola, Machinery Building, Temple of Music, Electric Tower and Reflection in Lake.

The illustration, Fig. 3, shows the exhibit of the American Vitrified Conduit Company, of 39-41 Cortlandt street, New York City, which is located on the north side of the Electricity Building near the entrance nearest the Electric Tower. Mr. Wardell E. Brown is in charge of the exhibit. The multiple conduit show consists of not only single, double and six duct conduits but also perfectly formed conduits of 9, 12 and 16 ducts. The company turns out conduit at the rate of 80,000 duct feet per day. The single ducts with butt ends as well as the self-centering types are constructed in lengths of 18 inches. The rapid transit tunnel in New York will require about 20,000,000 feet while the Manhattan Elevated Railway Company uses over 2,000,000 feet of this conduit. Next week **ELECTRICITY** will publish a daylight view of the Electricity Building together with a night view of the same scene, the fountain basin in front of the Electric Tower reflecting the thousands of decorative lights on the Electricity Building with a most beautiful effect.

MISCELLANEOUS NOTES OF INTEREST TO CENTRAL STATION MEN.

BY W. H. WAKEMAN.

One objection to springing an arch over the top of a tubular boiler is that it tends to spread the side walls and there are enough forces at work to disturb these walls without the arch. Another objection to it is that where it is close to the boiler when new, a slight settling of the arch may bring the whole weight of it on the boiler where it is not wanted.

Still another objection is that if a leak appears in any of the seams in the steam space it is difficult to get at it for the purpose of making repairs. These objections may have weight, or not, according to conditions, but I believe it possible to secure all of the benefits of a brick arch by using some material that is fully as good in every way, and still has the advantage of being much lighter. Asbestos in some of its various forms will answer every purpose.

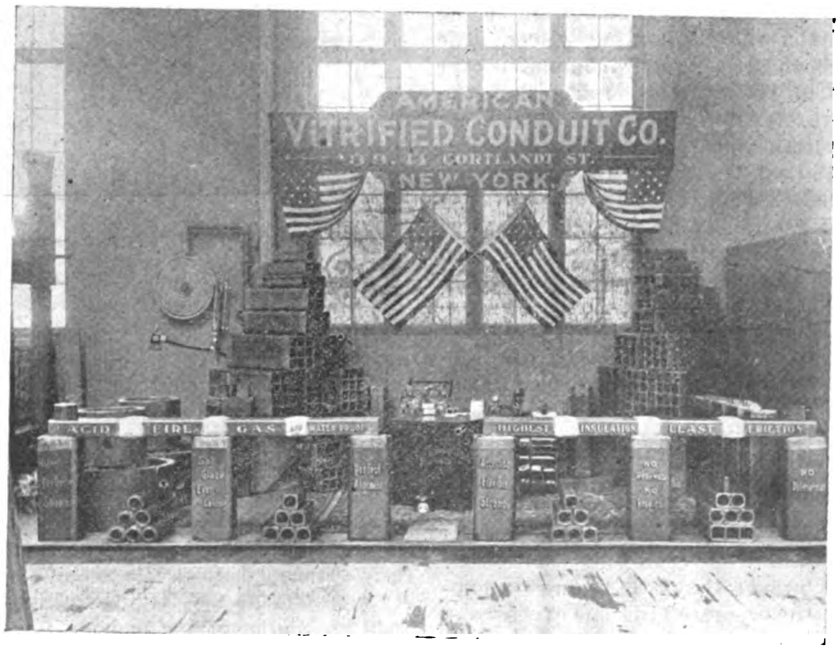

FIG. 3.—PAN-AMERICAN EXPOSITION.
Exhibit of American Vitrified Conduit Company in Electricity Building.

The power pump is an economical boiler feeder when used in connection with a good exhaust steam heater, because the power used to operate it is developed by the engine, and this is supposed to be of some approved kind which uses steam to a good advantage.

The direct acting steam pump is wasteful of steam, but its speed can be so nicely regulated to suit various requirements, that it is justly popular with engineers and steam users. Where a power pump is supplied with a device for regulating the amount of water delivered it becomes a very desirable machine. A set of cone pulleys by which the speed of its countershaft may be changed at will, or a circulating pipe that lets some of the water in the delivery pipe run back into the suction, will accomplish this result.

Thousands of dollars are now invested in separators where they were unknown a few years ago, and as a rule, to which there are very few exceptions, the investment is found to be profitable. With a good separator on the exhaust pipe of an engine, and a mineral oil used in the cylinder, it is practical to remove the oil, leaving the steam pure to use for other purposes, and making it safe and economical to return the water of condensation to the boilers. Some complaints are still made about the failure to take out all of the oil or grease, as it is commonly called, but where such is the case there is some cause for it, the same as there is for everything else. If a kind of cylinder oil has been used that comes out of the exhaust steam readily it is a very good plan to keep right on using that oil, and not experiment with some other kind that is of doubtful quality and of uncertain origin.

We are told that if the height of a brick chimney is accurately measured when cooled down to the temperature of the atmosphere, and again measured when heated by the passage of hot gases through it, the difference will be about one inch for each 25 feet in height. This does not apply to the outside of such a chimney where the heat does not affect it, but to the brick work that is actually heated to a high temperature.

This demonstrates that a chimney should stand by itself, and not be built rigidly into the walls of a building. It also shows that the outer and inner walls should be given a chance to expand and contract separately.

Some of our heavy duty steam engines with their massive frames are very stiff and unyielding, which of course is a very desirable feature where heavy and continuous work is to be done, but their very stiffness prevents that smooth and almost noiseless operation that characterizes others that spring and give to a slight extent. It is claimed that some engines will not run quietly when set on a perfectly rigid foundation, but we prefer the best one that can be laid, for in this case as in many others the best is none too good.

When the amount of cylinder oil that an engine requires per day is determined it is useless to feed more than is needed, as it is simply just so much wasted. Very few oil pumps operated by hand are now used for this purpose, because it requires to much time to attend to it, and a large quantity of oil put in once an hour does not answer the purpose as well as one or two drops per minute. A separator may work well on the exhaust pipe of an engine where a sight feed lubricator is used, that will not take out all of the oil delivered in large doses by a pump.

It is a good idea to have an injector piped so that it can take water from a tank with a lift of from 2 to 6 feet as the case may be. Many injectors that are found satisfactory when used in this way do not give good results when the water comes to them under pressure. If the pressure was always the same they would work better, but in ordinary cases others draw from the same pipe that feeds the injector, and when the engineer or fireman adjusts the water valve so that the supply is right for the steam pressure, there is no trouble, but when somebody opens a faucet and takes nearly all the water away from the boiler feeder, it "kicks," and in a few minutes the water pipe is filled with steam and hot water, which prevents it from working until the whole thing is cooled off. On the other hand, if it is piped so that it can only draw water from a tank on a lower level, something may cause it to "kick" in that case, and it must then be cooled off before it will work again. If this has to be done by pouring water over the injector and pipes, it does not improve the appearance of the room, therefore it is well to connect a pipe so that water can be forced through the suction pipe and injector for then the whole can be cooled without spilling water on the floor.

How little some engineers seem to care about keeping their machinery in good order. The corners of nuts are rounded off by using wrenches that spring, cold chisels are used on every convenient occasion, and Stilson wrenches are employed to loosen nuts and pipes where some other tool that would not leave "trade marks" behind it might just as well have been brought into service.

One of the worst cases of this kind that we have ever seen was where pipe tongs had been put on a piston rod that was about 3 inches in diameter in order to unscrew it from the cross head. Sufficient pressure had not been applied to the handles to make it hold at first, so that it had scraped along the surface of the rod until it finally "took hold," and brought the rod out.

If that engineer studied the wooden pulleys on the shafts of that mill he might have discovered that a block of wood when split in two and sawed out to fit a shaft or a piston rod, and bolted in place, will afford a good place for a large wrench to be used. When it is taken off it leaves no marks behind it.

ELECTRICITY IN MOUNTAIN MINES *

BY F. W. BRADY.

As the theories which are fundamental in the generation and transmission of electrical energy have been very largely represented in the proceedings of the Institute in papers of more or less heavy character, the writer has thought that it would not be out of place to present a descriptive article. The purpose is to give the particulars and details of a few plants illustrating the general conditions and difficulties to be encountered in making three different kinds of installations, a classification depending upon the location of the mines, viz., those reached only over burro trails, those by aerial wire rope tramways, and the ones having wagon roads of various grades and conditions.

In the Rocky Mountain district there are a large number of electric mining plants ranging from that of a single diamond prospecting drill to those operating a great variety of machinery and requiring several hundreds of horse power. Although there are some restrictions to its use, the application of electricity in such plants is ideal, in fact, any other style of operation is prohibitive. Wood, water and coal are not available in many cases, and the mines are located frequently on the face of precipitous cliffs, and inaccessible except over a trail or an aerial tramway. While this is true of those already equipped, there are other mines waiting for similar improvements, cases where it is necessary for some one to "find out men's want and need, and meet them there."

The use of electricity has greatly improved the methods of working the mines and gives a corresponding increase in their value. A large number now have electrically lighted tunnels and mine buildings, electric driven hoists, air compressors to operate drills and forges, pumps, blowers and mills. Of course electricity in mining operations, like its applications in all other industries, has been a gradually progressing science, its present perfection being the outcome of many trials and failures, mistakes and disappointments.

Beautiful creations of the designer, the founders' art, and the machinists' pride have left the assembly room with cheers for "bon voyage," but alas never to perform a useful service, unless 'tis "men's want and need" to increase the dump of some mine or add to the momentum of an avalanche of tin cans in the mountain gulches.

Imagine, if you can, a cast iron drum 4½ x 5 ft., weighing 3,500 pounds, and made all in one piece, to be transported over a burro trail, places in which a tenderfoot would hesitate to tread! Such designs have a delightful car ride of more than 1,000 miles only to find a final resting place two or three miles from the mine where intended to be used.

The first requirement in making such mining installations is to get reliable data of the capacity of the water power. Generally the plants installed far exceed the power available to drive them. The report of the constructing engineer should be very elaborate, not only regarding the water power, but also conditions in the mine, the methods of transportation, special requirements in design of apparatus, maximum weight of parts and dimensions, the topography of the district for pipe lines, transmission lines, etc. As mountain streams are so variable, it requires measurements for a period of several years to get any reliable basis to work on. From the very nature of the case, such installations are far from the base of supplies and in locations often where little or no mechanical or electrical work had ever been previously attempted. Even at best an unlimited number of schemes and devices must be worked out on the spot to facilitate the transportation, construction and operation of the plant.

It must be understood that in making any legitimate installation the purchaser from his standpoint insists upon quality of apparatus and construction and certainty of operation, the plant filling the needs of the mine in all the particulars guaranteed before its adoption. On the other hand, the contractor wishes the plant erected at minimum cost, and to be promptly accepted and paid for.

The plant of the American-Nettie Gold Mine, of Ouray, Col., is a good example of an installation in which all the mine machinery and most of the materials for the transmission line were transported from the railway over a burro trail. The source of power for the plant is the Uncompahgre River, a dashing mountain stream fed by springs and heavy snows from a very large area of an intensely rugged range. There is a considerable variation in the volume of the flow of the stream, the lowest being in February and March, when there is the least thaw and the streams are frozen. The flow at this time was found to be 960 cubic feet per minute. The river also has a daily variation, being lowest about three o'clock A. M., and the highest in the evening. The flow is also cut off temporarily at times by big snow slides which close the stream until it can melt through.

The highest water is in early July, when the first hot days in this region bring down all the snow from the immediate foot hills. No measure was secured of this flood stage. A 30' log dam, a penstock 18' high x 6' square, and 400' of 4' x 5' flume with sand box and screens were erected in the winter during the lowest stage of water. Ten feet of the penstock was built of 2" x 6" plank laid flatwise in tar and spiked together; upper 8' of 2" x 4". Four 1" anchor bolts extended through the entire height. The pipe line was 1,400 feet long and 30 inches in diameter and made of No. 14 B & S steel. These plates as received were 36" x 96", and weighed from 65 to 70 pounds each. These were punched, rolled and riveted and six sheets put together, the horizontal seams being double, and the vertical ones single riveted and making sections 17½ feet long. These sections were then dipped in a hot bath of maltha and coal tar and thoroughly coated inside and out. Ten barrels of the compound were required for the job. After drying they were hauled to the grade and put together as follows: beginning at the wheel end the sections were united by a 6 inch telescope joint. The larger ends of the sections were expanded by sprinkling with gasoline oil and firing. This

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* A paper read at the 153d Meeting of the American Institute of Electrical Engineers, New York.

process also softened the compound and aided in making a tight joint. The sections were forced together by using a set of triple blocks on each side, having two men operating each set of blocks and a fifth man to guide the end of the pipe and at the same time jar it to a tight fit by using a sledge against a block of wood on the end of the pipe. As the line was straight, and the fall not over 75 feet, this style of joint proved very effective. The wheel opening being 24", a reducing section was necessary at this end. A 14" manhole and a hose connection was also placed in this section. The connection at the penstock was enlarged from 30 to 36 inches to allow an easy entrance for the water.

A 3 inch air valve was inserted in the pipe on the highest vertical bend. Most of the pipe was laid on an elevated grade. It crossed the stream from which the water was taken, and required two special bridges for this transfer. Practically the whole of the pipe was therefore subject to the extreme changes of temperature. Such a pipe should be kept full of water to prevent undue expansion and contraction. If not, there will be excessive leakage.

The building erected to house the machinery was a two story frame structure 30' x 32', the second story being used as a residence for the operator. The plan was made to accommodate duplicate generators to be operated by a 20-inch double discharge Leffel turbine with horizontal shaft and friction clutch pulleys, 28" diameter x 13" face, one for each unit. The turbine with its two 12" x 4' draft tubes was set on foundations as directed by the makers.

The foundations for machinery and building were made of rock and cement. However, the "I" beams composing the longitudinal part of the frame were deflected sidewise by the water pressure, and it became necessary to bring them into line again by the use of jack-screws, and then to extend the concrete foundation to the top of the beams. The wheel was fitted with a Wood governor, which worked very well for small variations of load; but for large ones like that caused by the starting of a compressor, it was of no value in this plant. When such changes were to be made, the operator was notified by telephone, and hand regulation was applied to the wheel. Without this hand regulation, the incandescent lights would be destroyed when a heavy load was thrown off. The plant was operated continuously.

The switchboard was made of kiln dried maple, and arranged for the duplicate 60 kw. 500-volt compound generators.

The line extended over a very rough section of country, and was rather difficult both to locate and to construct. There were several zigzags so as to cross the cliffs where it was possible for men to approach the route. Trees were used for poles wherever possible. Other poles were cut from the nearest timber, and rolled or dragged into position, and set in holes blasted from the rock by the use of dynamite. Heavy guys and double cross-arms were frequently used along the line. The wire, 000 B & S bare copper, was received on wooden spools in lengths of 1,000 feet (500 pounds). It was desired to take about one-third of these coils to the mine and run them out from that end. As 500 pounds was too heavy for one mule to carry, and as it was preferable not to cut the wire, they were transported as follows; The wooden spools were removed from the wire, and the coils separated into four parts with connecting links. Two of these were placed on the pack saddle of one mule, one on each side, so as to balance. The other two were similarly placed on a second mule, the animals being connected by the 10 or 15 feet of wire between the two loads. The outfit could then move single file up the trail. At the mine the four sections were replaced on the spools, which served as reels when placed on a spindle anchored to a tree. The end of the wire was passed through a friction clutch made of two pieces of plank bolted together, and then guided down the route of the poles by several men. A second section was then spliced and soldered to the first, and the operation continued until 3,000 feet of wire was drawn out, 1,500 feet on each side. Other sections were then drawn out by men and horses from various locations along the route, which could be most easily reached, for the total length of 4,400 feet. The completed joints were made Western Union style and soldered by pouring the molten solder over them. The wire was laid up and drawn into position in the usual manner. Special railway insulators were used to anchor the wire on the tops of high bluffs. Care should be taken in such rough country to set the cross-arms on the poles so that the grooves of the insulators will be in line with the wire, also that such construction be made extra good and strong.

The mine consisted of a series of tunnels opening in the face of quartzite ledges on the mountain side at an elevation of about ,500 feet. These tunnels were connected by a network of excavations from which ore had been taken. The tunnels were of irregular size, varying from that of a rectangle less than 4" x 6" to very large rooms or cavities. The mine was practically dry, though some water accumulated in two or three places.

The mine equipment besides incandescent lights in the tunnels and buildings was as follows: One 12 x 12 inch high altitude type of Norwalk compressor, a No. 4½ Baker blower, and a Lidgerwood hoist. The machines were housed in good sized rooms made of boards and corrugated iron. It is necessary to cover such machines with a tight and strong roof to prevent small pieces of rock from dropping into the working parts. A substantial room for each machine is advisable, which can be locked to prevent meddling by employes other than the ones directly in charge.

The compressor was set in an offset from the main tunnel about 1,000 feet from the entrance, and near the work to be done. This method of location is important, as it saves power, cost of installation, and avoids loss by leakage of pipes. No. 0 B & S insulated wire was used in this tunnel. The compressor was operated by a 35 kw. shunt motor geared on the same bed plate. The air receiver, 30 inch in diameter x 10 feet, was located about 20 feet from the compressor. The jackets of the air cylinders and the intercooler were supplied with water from two 735 gallon tanks located about 100 feet from the compressor. A centrifugal pump was driven by belt from the intermediate shaft of the machine, and forced the circulation of the water through suitable piping. From 10 to 18 gallons of water per minute were passed through the compressor and kept it in fair condition. The speed of the compressor varied from 150 to 200 revolutions per minute, and when operating two Ingersoll-Sargent drills and furnishing blast for one forge at a pressure from 60 to 80 pounds, the motor required from 65 to 80 amperes at 450 to 475 volts.

The No. 4½ Baker blower was located about 200 feet in the tunnel in the "Y" formed by a branch. A 15 inch galvanized iron pipe extended from the blower to near the head workings. The blower was operated by a 6 kw. shunt motor arranged with a reversing switch so that the smoke could be exhausted directly from the head of the mine without scattering it through the other tunnels. Also by this method fresh air could be sent directly to the miners, and the work carried on with the least interruption possible. The blower required 7 to 10 amperes at 475 volts.

The hoist was set up in a branch from the extreme inner end of the main tunnel some .300 feet from the compressor. It was of the Lidgerwood style, operated by a 25 kw. series street car motor controlled in the same manner. It was arranged with a drum for 600 feet of ⅞ inch wire rope in one layer. The shop test of the motor showed 1,300 pounds raised 600 feet per minute. The normal load was 700 pounds at 600 feet per minute.

The wire in the tunnels was of heavy weather proof insulation tied to heavy porcelain insulators bolted to wooden pins which were driven into holes drilled in the quartzite roof and walls. The location of the holes for the insulator supports, so as to have the wire clear all obstructions, was done by two men, each with a lighted candle. By holding a candle at one pin and the other a few feet ahead at such points as allowed the lights to be seen by both men, the proper places for the pins were rapidly located. There was a heavy condensation of moisture on the insulators and wire. This was effectively prevented by coating them with P & B paint.

One of the greatest troubles experienced in the operation of high altitude electrical plants is from lightning. Electrical storms are of very frequent occurrence, heavy discharges from the lines happening sometimes during clear weather. The arresters used on this plant were of the General Electric Company magnetic blow-out type. Four were placed at the mine and two at the station. As the mine was a dry one, it was difficult to get a suitable ground at that end. A good sized basin was blasted out of the quartzite near the mouth of the tunnel, and this was filled with charcoal, and the arresters grounded to a copper plate placed in it. The basin was kept damp by water occasionally thrown in it.

The transportation of the station materials and machinery was done by wagons in the usual manner. But that for the mine had to be taken over a very steep, crooked and more or less dangerous trail. All apparatus had to be entirely dismantled. The small parts and attachments were packed in ore sacks and carried on burros. The next larger sizes, such as bearings, small gears, pulleys, etc., were wrapped in sacks and loaded on mules. All pieces too heavy for mules or of such shape that they could not be balanced on the pack saddles, were moved on sleds. These sleds were made of 2 x 4 inch pine, from three to eight feet long, and having a width of 20 inches. A sled was used for each of the pieces such as armatures, fields, pole pieces, sections of bed plates, gears, cylinders, air receiver, etc. Some of these pieces required the use of four horses in tandem to move them on the trail. In passing the zigzags, blocks and ropes with two horses pulling down hill, was found to be the most secure and rapid method. Several of the parts of the equipment required the use of four horses, three men and a good supply of tackle, crowbars, etc., about five days to move each one to the mine from the railway station, a distance of about two and a half miles. Only a few pieces received scratches and bruises, and only one piece jumped the trail, and this fortunately did not receive serious damage.

A rough test was made of the station. While not strictly accurate, it may be of some value in planning such installations.

When the output of the generator was 85 amperes at 575 volts, the average velocity of the water in the tail race was 188 feet per minute. The tail race, 6 feet x 7½ inches wide x 4 feet deep x 150 feet long, was made of planks, and had a fall of three sixteenth inch per foot. The water velocity as given was obtained by counting the time for light floats to travel about three-quarters of the length of the race. These floats were placed in the middle, and in various parts of the surface of the stream. The depth of the water for this load was from 9¾ to 10 inches.

The approximate cubic feet per minute was then as follows:

$$\frac{79\tfrac{1}{2} \times 10 \times 183}{144} = 1{,}033.$$

Elevation of standing water in the penstock 103 feet above datum.

Elevation of standing water in the lower end of draft tubes 26.2 feet.

Total head = 103 — 26.2 = 76.8 feet.

Friction loss in 30-inch pipe for 1,037 cu. ft. per min. = 4 3 feet.

Effective head = 76.8 — 4.3 = 72.5 feet.

$$\text{HP. of water } \frac{1{,}033 \times 62\tfrac{1}{2} \times 72.5}{1{,}033} = 142.$$

$$\text{Electrical HP. output} = \frac{85 \times 575}{746} = 65\ 5.$$

Velocity of water in tail race for friction of station plus 40 — 20 cp. 3 6 watt lamps was 88.8 feet per min., the depth 4 inches = 19.6 cu. ft. per min.

HP. of water for friction plus the 40 lamps =

$$\frac{19.6 \times 72\tfrac{1}{2} \times 62\tfrac{1}{2}}{330{,}000} = 26\ 9.$$

A diamond drill outfit for the San Bernardo silver mine of San Bernardo, Col., presents an example of construction work where it was necessary to transport the machinery and materials over a wire rope tramway. The plant was also installed in midwinter when the country was buried in snow, many of the gulches being filled, and the tops of large trees covered from sight. The source of power is Trout Lake, a pretty pool of water near the summit of the range, The same source also furnished power for the Telluride high tension long distance transmission plant, which has been described in the "Transactions*." A 6 kw. 250 volt generator was installed in the concentrating mill and belted through a countershaft to one of the two turbine wheels which operated the mill. The wheels had no regulators, but operated the generator at near enough constant speed for all practical purposes for the work when the whole mill was running. But when operating the generator alone, the wheel was constantly racing with the change of load, and regulation was necessary, which was had by putting a friction brake on the shaft of the wheel to be operated by a hand lever.

The required 2,500 feet of line was erected in most part on the towers of the tramway. That in the tunnel was fastened on porcelain insulators bolted to the framing timbers.

It was desired that no piece of the machinery should weigh over 250 pounds, but the designer did not entirely comply with this request. Fortunately no damage was caused by the extra weight of some pieces. The drill had to be entirely dismantled, and the parts packed in ore buckets, and dropped at the nearest point to the tunnel opening. From here they were rolled and dragged through the snow to the tunnel. The machine was set up for work, some 740 feet within the tunnel. It is the testimony of those who have tried it, that there is some difference between the ease with which a complicated machine can be set up in a wet tunnel, and in the assembly room as conveniently arranged as in the factory. The drill was of 600 feet capacity, and its total weight with the rods about 5,000 pounds. The dimensions were as follows: Length 9 feet, width 4 feet, height 6½ feet. The drill rod was operated by a 2 kw. shunt motor, which required from 6 to 8 amperes at 240 volts for normal operation, and 10 to 12 amperes when choked up. A 2½ by 4 inch Gould triplex plunger pump furnished water under 40 to 60 pounds pressure to the drill, this motor requiring about 10 amperes. The drill rods were 1⅝ inches outside diameter and for ¾ inch core, and made in 8 feet sections. The outfit was furnished with two bits set with eight 2-carat stones each, and with five blanks. The machine drilled from 7 to 10 feet per day of eight hours operation, and required a newly set bit each day.

As a representative plant reached by a wagon road, that of the New York and Chance Mines of Creed, Col., may be given. This was not so difficult in some respects to construct as the one for the American Nettie Mine. All the machinery was transported on wagons over a road constructed at great expense for the mining district. The power station is a frame building located on West Willow Creek in the canon behind Bachelor Mountain about 1½ miles from Creed. This town consists of a few frame buildings, the whole outfit appearing as if it had been driven like a wedge into the canon until the two rows of houses had become so squeezed (the town was built under pressure) that they had to climb the mountain sides in order to leave a little space between them for the entrance of pack trains and the inhabitants. Amethyst is located a mile farther down, and has more room. The plat of the two towns resembles a fan, Creed being the handle.

The canon begins an abrupt ascent at the base of Bachelor Mountain, and the wagon road follows a steep and zigzag course to the mines, which are in the timber land near the top. Log foundations were used for the building and the machinery. The equipment consisted of a 5 foot Pelton wheel with two nozzels, 4 inch shafting, and necessary pulleys to drive two generators. The governor was of the differential type operated by a small water motor.

One multiplier 100 kw. 500-volt direct current generator was installed with the necessary switchboard. The line, 5,700 feet, was of 00 B & S wire with tree insulation. It followed a deep gulch and thence over a high and rocky cliff and across the timber lands above to an air shaft over one of the tunnels. At this point a Siemens lead covered cable of 240,000 circular mils was attached and led down the shaft and through the tunnel 400 feet to a hoist. A compressor was located along the line about half way between the power house and the mine. For lightning protection there were the magnetic blow-out arresters at the station, and a strand of barbed wire on the tops of the poles the entire length of the line. This wire was grounded frequently to the water pipe and to plates set in the ground. The Rand compressor was driven by a 45 kw. shunt motor belted to it. The hoist was equipped with a 35 hp. series motor with street car control. Such hoists are designed after the usual plans which have been approved in the construction of those operated by steam.

The dam was made of 6 by 6 inch sawed timber about 30 feet long by 10 feet high by 6 feet broad, the front and back being laid solid, the two parts joined by braces, and the space between filled with earth. The bottom was started in a trench cut in the rock, and the timber work filled with concrete for the first few feet. A plank spillway, 2 feet by 10 inches wide by 8½ feet long by 18 feet deep, carried the water to the penstock. The water pipe was of black iron, the upper half 22 inches and the lower 16 inches in diameter. The total length of 2,300 feet was made up of four different weights of iron. That at the wheel was No. 8 B & S, the remaining fourths of 10, 12 and 14 B & S respectively. The 24 foot sections complete with horizontal seams, double and vertical single riveted, bolted flanges, gaskets, etc., were shipped from Denver. The total head was 325 feet, and the effective pressure when operating was 145 pounds per inch. The plant could only be used part of the year, as the stream was generally dry during the summer.

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ELECTRICAL WAVE-TRANSMISSION.*

BY MICHAEL I. PUPIN, PH.D.

Electrical wave-transmission over a wire conductor has a mechanical analogy in wave-transmission over flexible cords. The application of a force to one end of a cord develops three reactions: mass, tensional, and frictional reactions. The energy used up in overcoming the first two is non-dissipative, i.e., it is stored up in the cord along which it is propagated; whereas, the energy consumed against frictional reaction is wasted as heat. Consequently, if there be sufficient frictional resistance, the wave will not extend far from the point at which the impressed force is applied before the energy imparted to the cord (as kinetic and tensional energy) becomes dissipated as heat. In the case of wave-transmission along a cord, it is this dissipative factor which causes the wave attenuation.

Similarly, when an alternating electromotive force acts on an electric circuit, the energy imparted to the wire conductor encounters three reactions: inductance reaction, which is the same in form as the kinetic reaction of a vibrating cord, and is non-dissipative, its work being stored up in the system as magnetic energy; capacity reaction, the law of action of which is identical with the law governing the tensional reaction in strings, likewise non dissipative; resistance reaction, in the overcoming of which heat is generated, therefore it is dissipative. Consequently in electrical wave-transmission, the energy is continually dissipated as heat on account of the resistance reaction and causes the attenuation which limits telephony over long conductors, particularly over cables.

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*"Transactions," Vol. IX, 1892, page 430.

*From the "Technology Quarterly," published by the Massachusetts Institute of Technology, Boston.

Evidently to diminish the attenuation in either of the above cases the non-dissipative factor must be made larger in comparison with the dissipative or frictional reaction, since a relatively smaller dissipation of energy would result. The conclusion is that the transmission over cords must be better through a dense medium, or cord, since the mass-reaction is thereby increased.

To illustrate this point, a light cord lying on an inclined rough surface may be set into periodic vibration at one end by a suitable mechanism. Owing to friction, the wave energy on the cord is propagated only a short distance, the attenuation being very marked. On increasing the tension and thereby increasing the tensional reaction, the wave progresses much further. By substituting a cord of larger mass, the distance of the wave propagation may be noticeably increased. With a given cord, if the tension has been increased as far as possible, what may be done to diminish the attenuation? Assuming that a heavier cord cannot be substituted, the effect of a cord of large mass may be secured by loading the cord with sinkers of metal at periodically recurring points. Certain experiments demonstrate clearly and beautifully that the transmission can be much improved in this manner, provided the sinkers are suitably arranged.

The following conclusions were drawn from the above experiments: (1) It is more efficient to transmit energy over a heavy than a light cord. (2) A cord, if periodically loaded, may be made equivalent within any degree of approximation, to a heavier uniform cord. It is to be observed that the distance between consecutive loads must be smaller than the length of the wave which is transmitted.

Similar experiments suggested to the author, in the earlier stages of the research, the manner of attacking the electric problem. In any circuit the magnetic inductance (a source of non dissipative reaction) is limited. It is well-known that coils of wire possess large inductance, consequently such coils should act for an electric circuit in the same way that sinkers do for a cord, and the problem of electrical wave transmission should reduce itself to the placing of inductance coils at proper periodically recurring points on the wire.

In order that such a non-uniform, or loaded, conductor may act as a uniform conductor of large inductance, it is necessary from mathematical analysis to distribute the loads at periodic distances, which are small in comparison with the length of wave which is being propagated.

Since electrical waves in telephony are many miles long, it was impossible to carry out investigations on an actual line. An artificial cable, equivalent to 250 miles of line, was arranged in the laboratory at Columbia University, and inductances were placed at periodically recurring points. The current was measured and the waves plotted for the 250 miles. Using several frequencies the results of measurements were compared with the mathematical theory, and were in splendid agreement.

The practical value of this discovery is: (1) That wave-energy for telephony and telegraphy may be transferred over much greater distance. (2) If the distance remains constant, it enables wires of smaller size to be used, thus decreasing the cost of installation. (3) With the same weight of wire as in use at present, the distance of transmission may be greatly increased.

In the Atlantic cable, owing to the small magnetic reaction, and also small capacity reaction, the resistance reaction predominates by far, and the dissipation of energy is therefore enormous. By a proper distribution of inductance coils at periodically recurring points, say ⅛ of a mile apart, the inductance reaction can be made very much larger than the resistance reaction for all frequencies which are of importance in telephony, and thus the dissipation diminished to any desired limit. The discovery may, and it is confidently expected that it will, result in the telephonic transmission across the Atlantic.

BOILERS AND ENGINES FOR SUPERHEATED STEAM.

With the fuller understanding of the wasteful effects of cylinder condensation in steam engines, and with the improvements in the manufacture of high-temperature cylinder oils, there has come a revival in the employment of superheated steam. It is generally admitted that superheating is at present the most effective way to diminish internal losses due to condensation in the cylinder, and in practice the results have been such as to confirm the theoretical deductions.

In a paper recently presented before the Verein Deutscher Ingenieure at Essen, by Herr Hunger, says "The Engineering Magazine," the recent advances in the production and use of superheated steam are discussed, and some interesting practical points brought out

The proper use of superheated steam involves consideration both of the boiler and the engine, the superheater properly being an extension of the steam generating end of the plant, while the engine should be especially designed, if the best results are to be attained. The importance of designing the whole plant with a view to the use of superheated steam has been especially emphasized by Herr William Schmidt, who has realized some remarkable results with the engines and boilers constructed according to his plans.

In regard to the boiler, it is of much importance that ample space be provided in the flues to receive the superheater, and that an increase in chimney draft be given to offset the increased resistance to the gases in passing through the space about the superheater tubes. When proper care is not taken it is found that the boiler efficiency is reduced by the introduction of a superheater, but Herr Hunger cites a case of a boiler which was thrown out because of its poor efficiency, and which when properly reset, in connection with a superheater showed the high efficiency of 78 per cent.

The steam engine should be designed with especial reference to the use of superheated steam. It is a common error to make the cylinder too small, using the same dimensions as would be required for saturated steam. In a given engine, for the same point of cut off, steam superheated to 300° to 350° C. gives less power than saturated steam. The pressure of superheated steam falls more rapidly during expansion than is the case with saturated steam. For these reasons it is necessary for the same power, to make the diameter of the cylinder somewhat greater for use with highly superheated steam than when saturated steam is employed. With many forms of engine it is impossible to use steam heated above 300° C., because of the effects of expansion upon the metal of the cylinder. When the ports are cast upon one side of the cylinder, the unequal expansion causes a warping and curvature which may cause the piston to bind, producing excessive friction and wear. In the case of a 1,500 hp. engine tested by Prof. Schröter, it was found impossible to start when the temperature was raised above 220° C., as the piston bound in the cylinder. For the same reason it is difficult to obtain good results with slide valves, or with cylindrical valves, and poppet valves have been found preferable. Many such points have arisen in the attempts to use highly superheated steam in practice, and hence it is important that such difficulties should be known and considered in new installations.

Herr Hunger calls attention to several points of importance in connection with the design of superheater plants, which embody the results of much experience. The best boiler for this service is the shell boiler with large steam and water space, permitting good combustion, and generous proportion of flues. The earlier superheaters consisted of arrangements of spiral tubes, connected in such a manner that the whole was disabled in case of a leak, involving the tearing out of a portion of the boiler brickwork in case of repairs. Modern practice avoids the use of right-and-left threads or other joints exposed to the action of the heat, and provides for access to all the points from the outside, without disturbing brickwork; and it should be possible to cut any section in which a leaky tube or member may occur without disabling the entire system. With regard to the engine, the general form of the modern steam engine may be followed, but especial care should be taken that the high temperature shall not act to curve the cylinder. The valves and stuffing boxes must be constructed to withstand the heat, and to remain both tight and free to move.

Superheaters are generally placed behind the boilers, in the flue leading to the chimney, although when the space is too contracted to permit of this arrangement a chamber may be constructed above the boiler. Care should be taken to permit the superheater tubes to be well drained, as otherwise water is apt to collect in the lower portion, and in spite of the heat it remains difficult to dislodge, since in most instances there is no provision for water circulation. The space taken up by the water diminishes the capacity of the superheater, and the water is apt to be carried over suddenly to the engines, with disastrous results.

In designing the flues for conducting the gases to the superheater, arrangement should be made to divert a portion of the gases from the superheater by a by-pass, otherwise, when the boiler is forced, excessive superheating may result, to the injury of the engines. A rate of combustion of about 80 kilograms of coal per square meter of grate (about 16.5 pounds per square foot) has been found to deliver the gases to the superheater at a sufficiently high temperature to insure satisfactory superheating; the proportion varying somewhat with the character of the boiler and the nature of the fuel.

In some cases, where the boiler plant is already in use, and superheating is desired, it has been found preferable to construct a separately fired superheater. The principal objection to this apparatus lies in the fact that the gases coming directly from the fire are too hot to be permitted to come into immediate contact with the superheater, as too high a degree of superheat would be produced and the tubes would also speedily be destroyed. Such furnaces have been arranged to admit a proportion of external air to mix with the hot gases, but this is a wasteful method, and it is better to arrange a feed water heater to receive the first force of the fire, and permit the gases then to reach the superheater.

Data from a number of tests are given, showing the economy of engines working with superheated steam, the best of these being a 200 hp. engine, tandem-compound, which with steam superheated to 346° C. required 4 87 kilograms steam (10.07 pounds) per indicated horse-power-hour.

Instructions for Setting Up, Operating and Maintaining Stationary Batteries.

A catalogue recently issued by the Gould Storage Battery Company, Depew, N. Y., contains the following rules and instructions for batteries, which are well worth reproducing.

1. Unpack the cases carefully, opening them from the marked side, and clean elements and containing cells (glass jars, rubber cells or lead lined wooden tanks, as the case may be).

2. In moving elements, always lift them by both top bars.

3. Place cells in desired position, leaving a space of about one inch between jars on battery stands, which should be erected in a cool, accessible place, where they will not be exposed to dust or dampness.

4. Scrape lead connecting lugs and connect up, being careful to join adjacent cells in series; that is, positive to negative. The positive plates are stamped P or +, and are of a dark brown color, while the negatives are of a dark gray. Screw connecting bolts or binders up tightly.

5. The acid solution should be mixed one day before it is wanted for use, to allow it to cool. Under no circumstances fill cells with warm acid. The acid solution should have a strength of twenty-five degrees Baumé, which should be maintained at all times when cells are fully charged.

6. If current for charging be available, acid solution may be poured in the containing cells, one-half inch above plates, but do not fill cells unless they can be connected to the charging circuit at once.

7. Immediately after filling cells, connect charging current and charge at one-half normal rate for four hours, then increase to normal rate, and charge for about twenty hours.

8. Before closing circuit, be sure that the dynamo positive is connected to battery positive, and dynamo negative to battery negative, and that the voltage of the dynamo is 10 per cent. higher than the battery voltage.

9. At the end of the first charge, each cell should read 2.7 volts, and gas should be given off freely, the solution assuming the appearance of boiling.

10. Subsequent charging should be stopped when voltage is 2.6 volts per cell and gas is given off.

11. Discharge should be stopped and cells immediately recharged when voltage is down to 1.8 volts per cell when discharging at normal rate.

12. Always keep the plates well covered with the electrolyte acid solution.

13. Exclude all dirt, metallic particles or foreign matter from the cells.

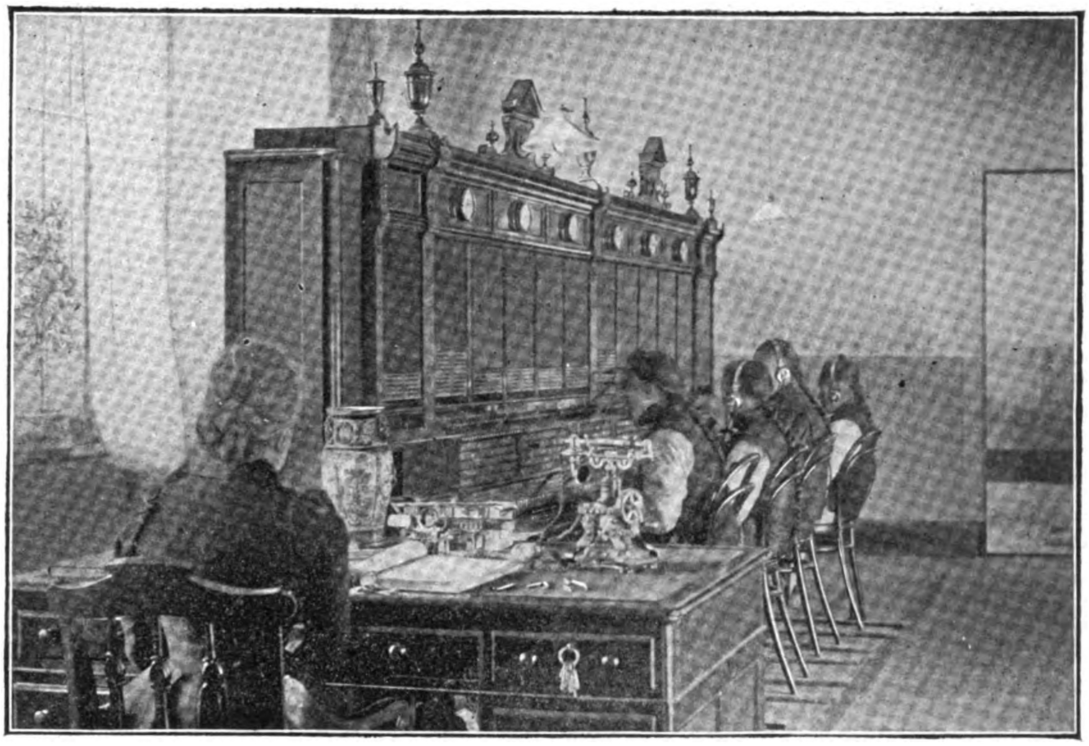
14. Test cells individually at regular intervals with both hydrometer and cell tester. Should any cell read low, cut it out of circuit for one discharge (thereby giving it an extra charge). If this does not bring it up to the proper condition, disconnect, take it apart, lifting the element from the jar by grasping it firmly by both cross bars, and wash it well, removing with a stick any foreign material which may adhere to the plates; attend to a low reading cell at once; do not wait.

15. Go over all connections regularly, and see that they are kept clean and tight.

THE SHANGHAI, CHINA, EXCHANGE.

While China is one of the largest countries of the world in point of area and population, it is backward in many respects in adopting the improvements of modern times. With very few railway and telegraph lines, it has fewer telephone lines or exchanges.

By courtesy of the Ericsson Telephone Company, 296 Broadway, New York City, we illustrate the first sections of a telephone switchboard installed at Shanghai, China, recently placed in operation. This is a full multiple board made by L. M. Ericsson & Co., Stockholm, Sweden, and the ultimate capacity is 5,000 subscribers. Our readers will observe that while the "chief" is a lady operator, and was imported from Sweden with the switchboard, the others are all natives. It is said that they are remarkably apt in learning to operate, quick in their movements and naturally patient and persistent, and they readily become expert operators. With a good knowledge of the English language and an "open door" to enter the United States, it might be imagined that in this line the so-called "Heathen Chinee" would not be slow in occupying the field to a large extent, just as has been done by them in the hand laundry business.



Section of a Telephone Switchboard at Shanghai, China.

The operation of the Ericsson full multiple switchboard is extremely simple, each section being divided into five panels for convenience, and in large boards an annex is placed at each end. The plugs and cords are placed on two different planes, the answering below and the calling above, which is of great advantage to the operator as the answering jacks are just above the answering plugs, thus separating them entirely from the calling plugs and multiple jacks. In case of a call the operator answers and can connect directly from her own division with any other subscriber in the board, thus giving very quick service and saving the time of the calling subscriber and of the other operators.

Each operator has eighteen pairs of cords and plugs, which provides for the busiest exchanges. The board is so made that busy subscribers' lines can be removed from one operator to another, thus distributing the work quite evenly. Each operator has a counter, which records automatically all the out-going calls from her division of the board.

It is said that this will be made a model exchange, and additional sections are on the way to Shanghai now, which will increase the size of the board; other sections are to be supplied as may be required. As switchboards of this same pattern are already in operation in the United States, the Ericsson Company will take pleasure in giving further information to those who are interested.

Proposals Invited.

Sealed proposals for furnishing and installing an electric light and power plant at Fort Hunt, Va., will be received by the United States Engineer at Washington until August 9. Full information will be furnished upon application to Lieut. Col. Chas. J. Allen, Washington, D.C.

PERSONAL MENTION.

Mr. Thomas M. Rogers, president of the Worcester (Mass.) Electric Light Company, died at his home in that city last week.

Mr Charles Currie has been appointed vice-president and general manager of the Northern Ohio Traction Company at Akron.

Mr. Robert E. Wright of Allentown, Pa., has been chosen president of the Lehigh Valley Traction Company to succeed the late Albert L. Johnson.

INCORPORATIONS.

The Consumers' Gas, Fuel & Electric Company, Charlestown, Ill. Capital stock, $5,000. Incorporators: William P. Coffey, Joseph Cluke and Charles Newman.

The Electro Bronze Works, New York City. Capital stock, $100,000. Directors: F. A. Ringler, New York City; Justin Ringler, West Hoboken, N. J., and V. V. Steinbach, Brooklyn.

The Western Electrical Construction & Fire Alarm Company of Des Moines, Ia. Capital stock, $60,000. An amendment was filed with the Secretary of State changing the name to the Western Fire Alarm Company. Incorporators: J. R. Windsor, Edward Kunkle, W. M. Houston, J. H. Lyman and H. E. Jones.

COMMERCIAL PARAGRAPHS.

The Sprague Electric Company reports large sales of the Lundell fans this season. There has always been a great demand for these fans and their popularity is due to several superior features of design and construction. Light and power companies will be glad to learn that the Lundell motors and split-pole generators are now being made in sizes up to 1,000 hp. and 1,000 kw. respectively. Both classes of apparatus are in greater demand than ever. The Sprague Company is also doing a rushing business with the Greenfield interior conduits and cables, the sales being unusually large.

The Farr Telephone & Construction Supply Company of Chicago, in an attractive little pamphlet, recently issued, says:

"Several years ago when we started the manufacture of telephones the demand was for cheap telephones. We had a large trade at that time, giving the very best goods possible for the money. We wish to inform those who may think we are only making a cheap grade of goods that we have always been equal to the demand, and are manufacturing the very highest grade of telephone on the market. We are making magneto bells, five bar magnets, laminated armatures, with an output of from 50,000 to 100,000 ohms resistance for bridging lines. We guarantee our goods or money refunded."

Practical Information About the Adirondack Mountains.

No. 20 of the "Four Track Series," entitled "The Adirondack Mountains and How to Reach Them," has just been issued by the Passenger Department of the New York Central & Hudson River Railroad.

This folder contains an immense amount of practical information about the Adirondack Mountains in a condensed but very comprehensive form.

It has two maps of this wonderful region, carefully revised to date that are marvels of accuracy and beauty, also a complete list of hotels, boarding houses, private camps, lakes, rivers, etc., plainly and correctly located on the map by marginal references, and which has been carefully corrected to date. The folder will be found an invaluable aid in arranging a trip to the mountains.

Other valuable features are a complete list of stage lines, steamer routes and other modes of conveyance in the Adirondack region, together with the rates of fare for same.

The time required to make the trip from any large city in the United States is also given.

A copy will be sent free, post-paid, to any address upon receipt of a postage stamp, by George H. Daniels, General passenger Agent, Grand Central Station, New York.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 9, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

677,848 677,849. Electric Railway. Frank M. Ashley, New York City. Filed Sept. 13, 1899.

677,881. Trolley. Thomas L. McElroy, Brooklyn, N. Y., assignor of two-thirds to Frederick A. Thomas, New York, and Theodore Honegger, New Brighton, N. Y. Filed Oct. 5, 1900.

677,958. Surface-Contact Railway. Philip Farnsworth, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 5, 1901.

678,023. Street Car Fender. Charles Nicholson, Brooklyn, N. Y. Filed April 3, 1900. Renewed May 22, 1901.

678,035. Electric-Railway System. Granville T. Woods, New York City, assignor to the Electro-Magnetic Traction Company, Washington, D. C. Filed July 24, 1895.

678,143. Trolley. Fred R. Taisey, Indianapolis, Ind. Filed Sept. 8, 1900.

678,195. Third-Rail Insulator. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 16, 1901.

678,213. Electric Railway. John M. Anck, Philadelphia, Pa. Filed April 24, 1901.

678,232. Fender. Carl F. Ekman, Marshalltown, Ia. Filed Dec. 24, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

677,873. Electric-Arc Lamp. Philip Luhr, Orange, N. J., assignor to the Manhattan General Construction Company of New York. Filed Aug. 15, 1900.

677,985. Electric-Arc Lamp. Daniel Higham, Winthrop, Highlands, Mass., assignor to the General Electric Company of New York. Filed April 22, 1901.

678,058. Electric-Arc Lamp. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Comany of New York. Filed April 8, 1901.

678,066. Electric-Arc Lamp. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company of New York. Filed Dec. 26, 1899.

678,142. Electric-Arc Lamp. William B Symons, Rhiwderin, Eng., assignor to Nettlefolds, Limited, Birmingham, Eng. Filed Feb. 15, 1901.

678,180. Switch for Electric Lights. Herman Horn, Philadelphia, Pa., assignor to the Horn & Brannen Manufacturing Company of Pennsylvania. Filed Oct. 11, 1900.

678,203. Inclosed Arc Lamp. Charles H. Way, Lansing, Mich. Filed June 16, 1900.

678,320. Incandescent Electric Lamp. Andrew H. Miller, Chesaning, Mich., assignor of one-half to Lester P. Burrows, same place. Filed Oct. 1, 1900.

678,3 4. Method of Operating Electric-Arc Lamps. Philip Luhr, Orange, N. J., assignor to the Manhattan General Construction Company of New York. Filed Dec. 26, 1900.

ELECTRICAL MACHINERY AND APPARATUS.

677,909. Construction of Electric Motors. James J. Wood, Fort Wayne, Ind. Filed April 23, 1900.

677,928. Electric Switch. Norman C. Bassett, Boston, Mass., assignor to the General Electric Company of New York. Filed April 28, 1900.

677,941. Rheostat. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Nov. 29, 1897.

677,970. Transformer. John J. Frank, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 25, 1901.

678,013. Controlling Means for Motors. Earl P. Mason, Newport, R. I. Filed Feb. 6, 1901.

678,029. System of Motor Control. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 29, 1900.

678,030. Electrical Conductor. Edward D. Priest, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed May 20, 1901.

678,034. Induction-Motor. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Nov. 28, 1898.

678,038-678,039. Insulating-Machine. Vernon Royle, Paterson, N. J. Filed March 15, 1901.

678,042. Rack-Insulator. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed May 1, 1901.

678,157. Dynamo-Electric Machine. Bjarni Bjarnson, Seattle, Wash. Filed Dec. 8, 1900.

678,167. Means for Controlling Electric Motors. Albert G. Davis and William B. Potter, Schenectady, N. Y., assignors to the General Electric Company of New York. Filed May 22, 1899.

678,171. Commutator for Electric Machines. Henry Geisenhoner, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 27, 1901.

678,178. Synchronizing Alternating-Current Machines. Edward M. Hewlett Schenectady, N. Y., assignor to the General Electric Company of New York. Filed July 28, 1899.

678,185. Protecting Generators in Transmission Plants. Thomas J. Johnston, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed July 18, 1899.

678,191. Alternating-Current Dynamo. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company of New York. Filed April 13, 1901.

678,233. Flux-Screen for Transformers. Augustine R. Everest, Lynn, Mass., assignor to the General Electric Company of New York. Filed March 4, 1899.

678,260. Ratchet-Operated Electric Switch. William Kingsland, London, Eng. Filed Jan. 16, 1901.

678,263. Electric Cloth-Cutting Machine. Robert E. Leve, New York City. Filed Feb. 8, 1901.

678,289. Compounding Alternator. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 10, 1898.

678,312. Electric Conveyor. John G. Gilmer, St. Petersburg, Fla. Filed Nov. 10, 1900.

678,332. Thermostat for Operating Valves. Joseph W. Eberman, Brooklyn, N. Y., assignor of five-eighths to Wilbur F. Steele, New York City. Filed Feb. 1, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

678,301. Telephone Circuit. William E. Pembleton, Wittenberg, Wis. Filed June 27, 1900.

MISCELLANEOUS.

677,862. Coil for Electromagnets and insulating Material Therefor. Elmer F. Dwyer, Lynn, Mass. Filed May 14, 1900.

677,955. Galvanic Battery. Levi G. Cunningham, Shellrock, Ia. Filed March 8, 1901.

677,957. Electric Meter. Albert G. Davis, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed May 17, 1901.

677,973. Lightning-Arrester. William D. Gharky, Philadelphia, Pa. Filed March 7, 1901.

677,980. Maximum-Current Indicator. Caryl D. Haskins, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 29, 1901.

677,986. Process of Making Accumulator-Electrodes. Heinrich F. Hobel, Berlin, Germany, assignor to the Accumulatoren and Electricitats-Werke Actiengesellschaft, vorm. W. A. Boese & Co., same place. Filed Jan. 14, 1901.

678,047. Induction-Coil. Harry Shoemaker, Philadelphia, Pa., assignor to Gustave P. Gehring, same place, Filed April 16, 1901.

678,063. Motor-Vehicle. Russell Thayer, Philadelphia, Pa, Filed Feb. 9, 1901.

678,069. Starting Device for Constant-Current Apparatus. Charles H. Van Slyck, New York City, assignor to the General Electric Company of New York. Filed May 9, 1901.

678,075. Preventing Creeping in Recording-Wattmeters. Frank G. Vaughen, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 1, 1901.

678,095. Electrically-Operated Musical Instrument. Herbert S. Brown, New York City. Filed Oct. 16, 1900.

678,116. Electrical Annunciator. Charles J. Kintner, New York City. Filed April 2, 1898.

678,122. Traction-Motor. Lowell M. Maxham and Artemas B. Upham, Boston, Mass. Filed Nov. 28, 1899.

678,133. Electrode for Secondary or Storage Batteries. Jacob Myers, Hoorn, Netherlands. Filed Feb. 25, 1901.

678,135. Electric Signal. John J. Ruddick, Newton, Mass. Filed July 30, 1900.

678,168. Magnet-Coil. Hermann F. T. Erben, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 22, 1901.

678,174. Phonograph. John R. Hare, Baltimore, Md. Filed March 26, 1901.

678,196. Electric Control System. William B. Potter and Frank E. Case, Schenectady, N. Y., assignors to the General Electric Company of New York. Filed Sept. 17, 1898.

678,236. Electric Measuring Instrument. Walter C. Fish, Lynn, Mass., assignor to the General Electric Company of New York. Filed April 4, 1901.

678,255. Process of Regenerating Accumulator Electrodes. Josef Hofmann, Berlin, Germany. Filed March 26, 1901

678,280. Coil-Forming Apparatus. John Riddell, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 19, 1901.

678,314. Electrical Water-Heater. Harry M. Hill, St. Louis, Mo. Filed July 2, 1900.

678,353. Inductance-Coil. Harry Shoemaker, Philadelphia, Pa., assignor to Gustave P. Gehring and Marie V. Gehring, same place. Filed Feb. 8, 1901.

DESIGN.

34,763. Stationary Plate for Static Machines. James M. G. Beard, Fruita, Col. Filed June 4, 1901. Term of Patent 14 years.

THE TELEPHONE WORLD.

Independent Companies to Unite.

Fifteen independent telephone companies of Northern Indiana are preparing to consolidate under one financial management, though each is to retain its local individuality with its local board of directors.

The object is to be in better position to issue bonds and otherwise finance the united properties.

J. R. Bates, inspector for the Memphis Telephone Company of Memphis, Tenn, who is at present located at Ponchatoula, La., has recently been in New Orleans on business for his company. This company is an independent concern that is just getting a foothold in Lousiana, and it proposes extending its lines to all points where there is any encouragement. It is a large competitor of the Cumberland and, Mr. Bates says, hopes soon to make some arrangements to get into New Orleans. "My business in Louisiana," said he, "is the buying and inspection of poles. We are buying a large number of poles along the line of the Illinois Central near Ponchatoula, and shipping them to Tennessee for our lines there. We have already put in telephones along the line of the Illinois Central at several prominent points, and it is the intention of the company to reach as many points as possible in the entire South. We are fighting the Cumberland in its own field, and doing so successfully, and have no fear but that we will be able to get our share of the business everywhere we go. I cannot say how long it will be before we are able to get into New Orleans, but I am satisfied that it is the intention of the company to run its lines to this city as soon as practicable."

The Bell Telephone Company, which has long been in a legal controversy with Richmond, Va., to continue to operate its plant there, was defeated in the board of aldermen by a vote of 9 to 8. The board decided to lay the Bell petition for a franchise for 30 years on the table until after the decision of the United States Supreme Court, in which is now pending the case of the city of Richmond against the Bell Company in the effort to run it out of the city. For years the Bell Company has been fighting the city which gave the Richmond Telephone Company, composed largely of local capital, a franchise several years ago.

According to a Hartford, Conn, paper, the Southern New England Telephone Company has sent out circulars announcing that hereafter the time limit of communications with persons outside the State will be reduced from five minutes to three, with a corresponding reduction for the initial period. Hereafter, a communication with New York, for instance, will cost 60 cents for three minutes instead of the old rate of 90 cents for five minutes. The night rate will be 30 cents for three minutes instead of 50 for five.

The Lehigh Telephone Company of Allentown, Pa, the State Belt and the Schuylkill Valley Telephone & Telegraph Company, which recently secured a franchise in Reading, will on July 19 apply to the Governor for permission to change their name to the Consolidated Telephone Company of Pennsylvania. The new company consolidates a number of the telephone companies in Eastern Pennsylvania and thus builds up a large system.

The Eastern Telephone Company is constructing a line from Norway to East, South and North Waterford, Me., extending to Lynchville and East Stoneham, with guarantee from responsible parties of an annual income of $500 for the next four years.

A statement was recently received from Chicago that the directors of the Central Union Telephone Company will meet July 31 to consider plans for raising $3,000,0000 new capital.

Increase of 32,137 instruments in the net output of the American Telephone & Telegraph Company for the month of June, as compared with the same month last year, making a net increase of 61,868 instruments since December 21 last.

A company has been formed and a charter applied for, the purpose of which is to build a telephone line from Jersey Shore to Wellsboro, Tioga County, Pa., traversing the Pine Creek region.

The line of the Ohio Telephone Construction Company, which extends from Butler to Greenville, a distance of 28 miles, has been absorbed by the Central Union Company.

New York has now 60,000 telephone stations, which rank it as the largest of the world's city telephone systems.

The Stites Telephone Company has completed a line between Stites and Grangeville, Idaho.

Delaware, Lackawanna & Western to Adopt Telephones.

A report from Scranton, Pa., states that telegraphic communication between stations of the Delaware. Lackawanna & Western Railroad, will within a few months be a thing of the past, so far as its connection with the railroad is concerned. Telephones, equipped with phonographs, so that an exact record of every word spoken can be obtained, are being rapidly substituted for the telegraph keys.

This experiment has been tried on the Morris & Essex division of the railroad, and is said by General Manager Thomas E. Clarke to have proven more satisfactory than even its most sanguine supporters anticipated. All the branches of the Delaware, Lackawanna & Western system are being equipped with the phonographic telephones, and within a few months, according to Mr. Clarke's estimate, the main line from New York to Buffalo will be operated by the new system.

"Managers of Western roads," said Mr. Clarke, "first recommended to me the use of the phonographic telephone instead of the telegraph. They told me that they had tried the experiment and that it had been successful. I think that the new system will save both time and expense."

L. B. Foley, telegraph superintendent of the Lackawanna system, when asked to estimate the reduction in expense of dispatching by telephone, replied that it would be nearly 60 per cent. cheaper.

"Train dispatching by means of the telegraph key is a method of the past," said Mr. Foley. "I am not astonished that our road has adopted telephones, and I have been expecting it for several months.

"There was grave doubt expressed at first by railroad men, because they said that responsibility would continually be in dispute, as no record could be kept of the messages sent without an unwarranted delay. By the introduction of the phonograph this difficulty has been obviated."

In operating the telephone system, each station will be supplied with a series of numbered blanks, on which it will be necessary to record only a few words to fill an order. That greater speed may be attained operators may be required to learn short hand. The phonographic records would act as an auditor of these blanks.

The Seattle, Wash., Automatic Telephone Company has notified the city that it is ready to show that it has 800 'phones in operation, as required by the franchise. The company has purchased the stock of the other new company, the Independent, which was recently granted a franchise but has not done any construction work. Both were started to compete with the Sunset Company, which is a branch of the American Bell. The Automatic Company does not purpose to install an automatic system, but will take the name of the Independent. It is owned by Ohio capitalists.

Manager Edward Merry, of the Wisconsin Telephone Company at Kaukauna, has received orders from his company to proceed at once with a crew of men to connect up its line with that of the Manitoba & Western Telephone Company, which has just reached Wrightstown with his line from Manitowoc. This company is building various short lines throughout the territory between Lake Michigan and Lake Winnebago.

Christ Pagel, president and general manager of the Union Telephone Company of Atwater, Minn., has been buying material for the company. The farmers are building a telephone line from Atwater along their line to Irving, Harrison, Spicer and Willmar. They have nearly all the poles and wire up and the farmers will soon be in a position to keep each other posted regarding the growth of wheat and corn.

Farmers residing in Cedar township, Iowa, have organized a telephone association with about 20 members. The line will connect with the lines of the Jefferson County Telephone Company in Fairfield, and will be given the use of the local switchboard.

The Louisville, Ky., Electric Light Company has sued the Cumberland Telephone Company to prevent poles being erected too closely together.

The National Automatic Telephone Company of Chicago through its representative, N. V. Perry, has opened offices in the Prudential Building, Atlanta, Ga.

Forty new telephones were installed in Burlington, Vt., last month.

The Southern Bell Telephone Company will put in an entirely new telephone system in Rome, Ga.

The telephone line is now complete through Elkdale, Pa.

To Consolidate Independent Companies of Wisconsin.

It is understood plans have been perfected for the consolidation of the independent telephone companies of Wisconsin. The matter has been kept a profound secret until recently, when it became known. President Lohmiller, of the La Crosse Independent Telephone Company has admitted that the plan was being seriously considered.

The Albany, N. Y., Home Telephone Company, by the president, Howard Hendrickson, has filed with Mayor Blessing two agreements, one accepting the ordinance passed on August 5, 1895, granting a franchise to the Home Standard Telephone Company, and the other assuming the bond of the Home Standard Telephone Company, whose franchise was transferred to the Albany Home Telephone Company on May 1, 1901. It appears from the two documents filed that the Albany Home Telephone Company proposes to carry on the general business of telephony and telegraphy under the authority granted by the franchise of August 5, 1895.

A lot of telephone material arrived at Alvin lately for the Texas Construction Company of San Antonio, which will be used in the construction of an independent telephone line between Houston and Galveston. This company will also establish an office in Alvin. The Alvin & Angleton Telephone Company will put in a local exchange there just as soon as arrangements can be perfected. Already enough subscribers have been secured to justify putting in a first-class exchange.

Harrisburg, Pa, is to have a third telephone company. There was trouble among the stockholders of the Dauphin County Telephone Company, organized and incorporated a short time ago. A split resulted and a charter is to be applied for the People's Telephone Company of Dauphin County. The one company doing business is the Pennsylvania.

The D. C. Telephone Company of McKinney, Tex., with a capital stock of $10,000, has been chartered to maintain a system of telephones in the counties of Collin, Dentor, Grayson, Wise, Cooke, Tarrant, Dallas, Hunt, Fannin, Ellis, Kaufman, Rockwall, Jack, Parker, Palo Pinto, Johnson, Hill and Navarro. J. B. Ray, W. A. Rhea and J. E. Mitchell are interested.

Tonganoxie, Kan., will soon have a telephone exchange. The contract has been let for the construction of a 100 'phone exchange. Most of the business houses have taken 'phones and quite a number of residences will have them also.

At a recent meeting of the board of aldermen of Paterson, N. J., a resolution was adopted requiring all telegraph, telephone and electric wires now strung overhead in Main and Market streets, to be placed underground forthwith.

The Southwestern Telephone Company of Galveston, Tex., is completing its underground conduit system, which represents a cost of nearly $80,000.

Excellent telephone service is now in operation at Rockland Lake, N. Y.

TELEPHONE INCORPORATIONS.

The Chipppewa Valley Telephone Company, Bruce, Wis. Capital stock, $10,000. Incorporators: O. E. Pederson, A. L. Arpin, A. Hein and ten others.

The McNabb Mutual Telephone Company, McNabb, Ill. Capital stock, $2,500. Incorporators: John N. Wilson, W. L. Mills and Vivian Haws.

The Palmer-Darnell Electric Company, McLean, Ill.—to operate a telephone system. Capital stock, $10,000. Incorporators: H. M. Palmer, W. C. Darnell and F. W. Aldrich.

The Franklin County Telephone Company, Charleston Ark. Capital stock, $2,000. Officers: K. E. Hudson, president; Joe Yunker, vice-president; J. S Smith, secretary and S. P. Gammill, treasurer.

The Long Distance Telephone Company, Oklahoma City, Okla. Capital stock, $5,000. Directors: George Todd, Oklahoma City; J. F. Noble, Shawnee; E. D. Nims, Roff, I. T.

The Home Telephone Company, Jamestown, N. Y.—to operate a telephone system in Cattaraugus and Chautauqua Counties, N. Y., and Warren and Erie Counties, Pa. Capital stock, $200,000. Directors: Julius V. Aulnet, Jr., E. E. Nash, C. B. Selby and G. B. Devoe, Warren, O.; P. G. Hoyt, M. N. Skiff and E. P. Putnam, Jamestown.

GENERAL ELECTRICAL NEWS.

Lighting.

Ada, I. T.—An electric light plant is to be established at this place.

Adel, Ga.—Waterworks and an electric light plant will be erected here. Address W. S. Witham, Atlanta.

Albany, Ga.—Moore and McCrary are the engineers for the new electric light plant to be built here.

Belton, Tex.—The Belton electric light plant has been sold to J. T. Smither and Frank E. Merrell of Temple.

Clarinda, Ia.—All of the $15,000 stock for a new electric light plant has been subscribed for by local business men.

Clinton, Ill.—The consolidation of the two electric light plants will take place as soon as possible. The plant formerly run by the Clinton Electric Light, Heat & Power Company will be used and the other plant closed.

Detroit, Mich.—Articles of association were filed recently by the Ginzel Construction Company. The purposes of the corporation are the building of gas and electric lighting plants, and doing all kinds of construction work. The capital stock of the company is $10,000, and the organizers are John Ginzel, Wyandotte; Matthew F. Bramley and John F. Cowing, Cleveland, and Stewart O. Van De Mark, Detroit.

Doylestown, O.—An electric light plant will be built here to cost about $9,000. G. W. Barkhamer, mayor.

Harrisburg, Ill.—The electric light plant in this city was lately sold to W. C. Thompson, of Chicago, for $15,000. Mr. Thompson is negotiating with the city to put in waterworks.

Haywards, Cal.—This city is discussing the question of electric lights and a water plant.

Humphrey, Neb.—An electric light plant will soon be in operation at this place.

Iuka, Miss.—Iuka has decided to issue $10,000 in bonds for the erection of a city electrical plant.

Jamestown, N. D.—The Jamestown Electric Light Company has sold its plant to John H. Canham, who has been in the company's employ for many years. Mr. Canham expects to make many improvements.

Manistee, Mich.—The citizens have voted to issue bonds for a municipal electric lighting plant. The present commercial plant may be purchased.

Marion, Wis.—A stock company has been formed for the establishment of an electric light plant here.

Maryville, Tenn.—An appropriation of $2,000 has been made by the college authorities to put in an electric plant. The matter has been deferred until the committee has further notice.

McKeesport, Pa.—An electric light plant to cost about $50,000 will be built here. Information may be obtained from J. B. Wampler.

New London, Wis.—The common council has taken steps toward the erection of an electric lighting and water plant.

Orlando, Fla.—The citizens have voted affirmatively on the establishment of an electric light plant, which, as reported recently, the Orlando Water & Light Company will be organized to operate. J. M. Cheney and associates are [illegible]

Park River, N. D.—Park River has disposed of its bonds for the waterworks and electric light plant.

Portland, Me.—The Eastport Electric Light Company, capitalized at $60,000, was lately organized by N. Curtis Fletcher, of Providence; Oscar A. Newell, of Central Falls, R. I.; Henry C. Smith, of Cranston, R. I.; A. S. Desmond and Harry L. Cram, of this city.

Sisseton, S. D.—This place is to have a first-class electric light plant. F. A. Leavitt of the Sisseton Roller Mills has secured a franchise from the city to operate such a plant for a period of twenty years.

West Bay City, Mich.—Mayor Peter Lind says that the city intends to purchase a 400 horse power engine for an electric light plant.

Williamstown, N. J.—The Monroe township committee has passed an ordinance giving the Wenonah, Glassboro & Clayton Electric Light Company the right to erect poles and string wires in the streets of this place.

Street Railways.

Albany N. Y.—The State Board of Railroad Commissioners has granted the application of the proposed Monticello, Fallsburgh & White Lake Railroad Company for authority to construct its road The company will operate an electric surface line, 16½ miles long, from the Fallsburgh station of the New York, Ontario & Western Railroad to Monticello, Sullivan County, and thence to White Lake.

Chambersburg, Pa.—The Chambersburg, Greencastle & Waynesboro Electric Railway Company will build a line from Greencastle to Pen Mar, a distance of 14 miles.

Clyde, N. Y.—The Clyde Electric & Power Company has made application to the board of trustees for consent to construct, maintain and operate a street surface railway, using electricity as a motive power.

Columbus, O.—The Columbus, Newark & Eastern Traction Company, with a capital stock of $10,000, has been organized by R. H. York, Harrison J. Uhl, A. G. Collins, Norton T. Horr and A. R. Horr. It is proposed to build an electric line from this city to Newark.

Detroit, Mich.—It is reported that the consolidation of the Detroit & Toledo Short Line Electric Railway Company with the Everett-Moore Syndicate was concluded July 10. Guy M. Walker, a Cleveland attorney, came to this city to close the deal.

Herkimer, N. Y.—Col. Clinton Beckwith is quoted as saying that if he can get the necessary material the new trolley line between here and Little Falls will be built before snow flies.

Iola, Kan.—The Iola Electric Railroad has filed an amendment to its charter increasing its capital stock from $50,000 to $150,000.

Joliet, Ill.—The Chicago & Joliet Electric Railway Company, located here, certified to an increase in capital stock from $605,000 to $2,300,000.

Kittanning, Pa.—A new trolley line from Graff to Rosston in Armstrong County has been surveyed. The officials of the Kittanning & Ford City Street Railway Company are interested in the new project.

Louisville, Ky.—The system of electric railways through the Bluegrass region, as proposed by the Bluegrass Rapid Transit Company, will be begun, if not completed, within the year.

Muncie, Ind.—A company is being formed to build an electric railroad from here to Union City, the tracks paralleling those of the Big Four. W. W. Orr of this city is the attorney.

New York City.—Residents and property owners along the Kingsbridge road from 166th street and Amsterdam avenue to Kingsbridge have won their fight for the construction of a street railway which will bring them into communication with the lines of the Metropolitan system. H. H. Vreeland, president of the Metropolitan Company, said last week that work upon this line would be begun at once, and that it would be finished within three months.

Norwalk, O.—Another electric railway company has been organized here. Sandusky people are back of the new enterprise.

Paducah, Ky.—An electric railway line from this city to Wickliffe is being strongly advocated here and at Wickliffe. A meeting of representatives citizens from Ballard county and this city, including the officials of the Paducah Street Railway Company, will probably be called at an early date to consider the matter.

Russell, Mass.—The Westfield Valley Electric Railway Association was lately formed here for the purpose of constructing a trolley line from Westfield to Chester, with branches to Blandford and Worthington.

Sioux City, Ia.—While steps are being taken to accomplish the organization of a construction company to build a line of electric railway from here to Omaha, another coterie of promoters, headed by H. A. Miller, president of the Metropolitan Business College, is projecting a second interurban line to run from this city to Le Mars.

Standish, Mich.—A new electric railroad company, with S. E. Hayes of this town as chief promoter, will soon be organized to extend a road from here north through Turner, Maple Ridge and other northern towns.

Steubenville, O.—The county commissioners have granted a franchise to W. B. Francis of Martin's Ferry, Theo. J. Stringer and James Beall of Jefferson County for an electric railroad to the Belmont County line, which is to be built from Martin's Ferry and from thence to Brilliant.

Terrell, Tex.—R. D. Wortham of St. Louis, representing a combination of capitalists of that city, has recently been here asking for a franchise for an electric line.

Valparaiso, Ind.—The city council has granted P. W. Clifford and C. W. Bartholomew of this city, representing a Chicago syndicate, a franchise for an interurban car line in this city, which will connect with Chicago via Hammond and Whiting and with Michigan City, LaPorte and South Bend.

Wheeling, W. Va.—J. Elwood Hughes has taken options on 800 acres three miles north for $240,000 for a syndicate of Philadelphians, who will parcel it out in lots and build a trolley car line to connect it with the city. Surveyors are at work.

Worcester, Mass.—The Worcester Railways & Investment Company, a new company, backed by Vermilye & Co. of New York, has been organized to finance the new system of street railways that has been established in the vicinity of this city. The new company has a capital of $6,000,000.

Manufacturing.

Jackson, Miss.—Andrew J. Bryan & Co., desire to correspond with manufacturers of elevators, electric plants, hotel telephones, ranges, switchboards, boilers, engines and other equipment for a hotel.

Company Matters.

Wheeling, W. Va.—W. F. Kimball, president of the Ohio Rapid Transit Company, an electric railway company that has franchises giving it access to every suburb within 25 miles of Wheeling, including a territory with a population of nearly 200,000 people, has announced that his company has entered into a contract with the Pennsylvania Railroad for the use of its Ohio River bridge into this city, and through the influence of the Pennsylvania had secured the money to build and equip all the lines for which it has franchises.

Power and Transmission.

Atlanta, Ga.—The question of a big lake and an electric power plant at the Chattahoochee River has again been brought before the public by the presence in the city of F. Morgan Smith, from York, Pa, It is said that he, together with his sons, are largely interested in the scheme.

Lake City, Col.—The Tobasco Company will erect a dam in the canon above Sherman for the generation of electric power. The contract will be let in a few days, and the dam is expected to cost $20,000.

Mines.

Henson, Col.—The Henson Creek Lead Mines Company has made arrangements for the erection of a dam and electric power plant, and work will shortly be commenced.

Automobiles.

Indianapolis, Ind.—The National Automobile & Electric Company has reduced its capital from $250,000 to $100,000.

Lockport, N. Y.—This week B. V. Covert will open up an automobile factory on Richmond avenue, where the automobile complete will be built. It is expected that between 30 and 40 men will be employed at first, and more will be given employment as soon as the factory can be put in condition to run.

San Francisco, Cal.—There is some talk of putting automobiles on Market street in opposition to the cable road. Among cable road people and automobile agents there is a deal of speculation as to just what is intended.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.–July 15						
United Traction (Consolidation of the Albany and Troy City Railway.)	100	$5,000,000	$5,000,000	1¼ % Q.,	106	108
Allentown Pa.–July 15						
Allentown & Lehigh Val. Trac. Co	...	4,000,000	1,500,000	....	--	15
Bridgeport, Conn–July 15:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug.,	100	...
Baltimore Md–July 15						
a United Rail ways & Elec. Co...com	50	24,000,000	18,000,000	....	16⅛	16⅝
Boston, Mass.–July 15						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan. 15,	...	--
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	15	16
North Shore Traction Co.........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	85	87
b West End Street Ry. Co......com.	50	10,000,000	[illegible]	3½ % S., Oct.,	95	95¼
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Jan.	110	110⅛
Boston Elevated R. R	100	10,000,000		2¼ % Aug. 99,	179	181
Brooklyn N. Y.–July 15:						
Brooklyn City Ry	100	2,000,000	1,928,400	....	241	245
Brooklyn Rap. Transit Co., tr certf.	100	43,000,000	43,000,000	....	75	75¼
c Brooklyn Heights Railroad	....	200,000	200,000	....	107	109
* *d* Brooklyn City RR.........guar	100	12,000,000	12,000,000	3½ % Q., Jan.,	237	239
e Brooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	2,000,000	1,884,200	2½ % Nov.,	325	330
Kings County Elevated	....	4,750,000	4,750,000	....	--	...
Kings County Traction Co	100	4,500,000	4,500,000	1 % July	..	..
Nassau Electric Railroad.......pfd.	......	6,000,000	6,000,000	....	82	83
f Atlantic Avenue Railroad	50	2,000,000	2,000,000	....	--	--
g Brooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	--	--
Buffalo N. Y.–July 15:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	74	75
*Buffalo Railway Co	100	6,000,000	5,370,500	1 % Q. Dec.	99	100
Columbus O.–July 15						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Feb.	38	39
Columbus Street Railroad, pfd	100	1,500,000	1,500,000	....	100	102
Charleston, S. C.–July 15						
Charleston City Ry. Co	50	100,000	100,000	3 % S.	--	--
Enterprise City RR. Co	25	1,000,000	250,000	....	--	--
Chicago, Ill.–July 15						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31,	250	260
Chicago & South Side R. T. RR	100	10,828,800	10,828,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	13¾	14
Metropolitan West Side Elev. Ry	100	15,000,000	7,000,000	Feb 28 1900.	34½	35
Met. West Side El., pfd	100	15,000,000	9,000,000	....	89	90
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan.	209	210
h North Chicago City RR	100	500,000	249,900	....	200	201
South Chicago City Railway	100	2,000,000	1,608,200	....	108	109
West Chicago St. RR. Co	100	20,000,000	18,189,000	1½ % Q., Feb.	100	101
Union Traction Ry...........com	....	1,250,000	624,900	35 %	16½	17
Union Traction Co...........pref.	100	2,000,000	2,000,000	5 % S.	57	59
Cincinnati, Ohio.–July 15:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	..
Cincinnati Inc. Plane Ry.......pfd.	50	150,000	150,000	½ % Feb.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	3,000,000	3,500,000	2½ % Feb.	75	76
l Cincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan.	124½	125
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan.	126¼	127
Cleveland, Ohio–July 15:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan.	48	50
Cleveland City Ry	100	8,000,000	7,600,000	3-5 % Jan.	100	102
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct.,	80	81
Detroit, Mich.–July 15						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	....	1,200,000	....	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.–July 15						
City Railway Co.............com	100	1,500,000	1,470,600	1¼ % Q.	140	145
City Railway Co.............pf	100	600,000	600,000	1½ % Q.	170	..
People's Street Railway		1,100,000	1,100,000	....	114	115

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.–Ju						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Oct.,	150	–
Hartford & West Hartford	100	1,000,000	247,000	....	--	–
Holyoke Mass.–July 15						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., June,	207½	212
Hoboken N. J.–July 15						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %,	180	–
Indianapolis, Ind–July 15						
**Indianapolis Street Ry	....	5,000,000	5,000,000	....	25	25½
Lancaster, Pa.–July 15						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	--	–
Lancaster & Col. Electric Ry	....	....	37,500	....	--	–
West End Street Railway	....	....	....	....	--	–
Louisville, Ky.–July 15:						
Louisville Ry...........com	100	4,000,000	3,500,000	1¼ %., April.	82	83
Louisville Ry...........pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1,	112	113
Minneapolis, Minn.–July 15						
Twin City Rapid Transit.......com.	100	17,000,000	15,010,000	....	89	89¼
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,712,200	1¾ %, Oct.	186	187
Montreal, Canada.–July 15						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	279	280
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¼ % S., J. & J.	109¾	110½
Memphis Tenn.–July 15						
Memphis Street Railway Co	100	500,000	500,000	....	25	–
New Haven, Conn.–July 15:						
Fair Haven & Westville RR	25	2,000,000	2,000,000	3 % S., Sept.	39	41
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July	...	...
New Haven & Centerville	100	700,000	800,000	....	..	–
Winchester Avenue RR	25	1,000,000	600,000	....	45	46
New Orleans, La.–July 15						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., July,	..	--
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Oct.	148½	158
New Orleans Traction Co new com.	100	....	....	....	26	28
New Orleans Traction Co new pfd.	100	....	....	....	102	103
a Crescent City RR...........guar.	100	2,000,000	2,000,000	3 % S., Jan.,	40½	36
b New Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan.,	..	--
Orleans Railroad	50	500,000	185,000	1½ %., June,	..	52
St. Charles Street Railway	50	1,000,000	1,000,000	1¼ %. Oct.,	56½	57
New York–July 15:						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	260
c Christopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Oct.,	175	185
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Nov.	120	125
d Metropolitan Street Ry. Co	100	45,000,000	45,000,000	2½ % Q., Feb., 1901	166¾	167
e Bleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July,	35	37
f Broadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	241	249
g Cen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	205	210
h Eighth Avenue RR	100	1,000,000	1,000,000	....	400	410
i 42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	392	402
j Ninth Avenue RR...........guar.	100	800,000	800,000	....	198	200
k Sixth Avenue RR...........guar	100	2,000,000	2,000,000	....	205	210
l Twenty-third St. R. R. Co..guar.	100	600,000	6 ,000	4½ % Q.	400	410
Second Avenue RR	100	2,500,000	1,8 ,000	2 % Q., Jan.,	210	212
Third Avenue RR	100	12,000,000	10,0 000	$1.75 p. sh. Feb.	121	121¼
m 42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,50 000	....	65	75
n Union (Huckleberry) Ry	100	2,000,000	2,00 000	....	190	200
Newark N. J. July 15						
Consolidated Traction Co of N. J	100	15,000,000	,000,000	....	67½	68
North Jersey Railway Co	100	6,000,000	000,000	....	24	25
United Elec. Co. of New Jersey	100	504,000	504,000	11¾ % A.	283½	284
Pittsburg, Pa.–July 15						
Allegheny Traction Co	50	500,000		....	27	28
o Consolidated Traction Co....com.	50	15,000,000		2 %, Jan.	19	21
Consolidated Traction Co......pfd.	50	9,478,850		3 %, Nov.	62½	63
p Central Traction Co	50	1,500,000		1½ % Nov.	78½	78¼
q Citizens' Traction Co	50	3,000,000		6 % A.	72½	72½
r Duquesne Traction Co	50	3,000,000		6 % A.	..	...
s Pittsburg Traction Co	50	2,500,000		3½ %, Nov.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000		2½ %, July,	27	29
Pgh., Allegheny & Man. Trac. Co	50	3,000,000		2 %, Aug.	..	..
Pittsburg & Birmingham Trac. Ry	25	1,500,000		1 %, Oct.	41	42¼
Pittsburg & West End Ry	50	3,000,000		5 % A., June	..	..
United Traction Co...........com.	50	17,000,000		J. & J.	8¼	18¼
United Traction Co...........pre	50	3,000,000		J. & J.	51½	52

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* Unlisted. † Ex div.

a The United Railways & Electric Company comprises in its organization the Baltimore Consolidated Railway Company, the Baltimore City Passenger Railway Company, all the lines of street railway operated by these companies, and also the Central Railway Co of Baltimore. The pref stock of U R & Elec Co has been issued in the form of income bonds.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railway Company, lessee.

l Cincinnati St. Railway purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‖ Outstanding. ‡ Ex-div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Ry. at 8 % on stock until Oct. 1, 1897; thereafter 9 %.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1895, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter.

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 % on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens' Duquesne, Fort Pitt & Pitt'b Traction.

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock.

s Leased to Consolidated Traction Company for 7 % on capital stock.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
New Bedford Mass.–July 15						
Union Street Railway Co.	100	$850,000	$850,000	2 %, Feb.	160	165
Northampton, Mass–July 15						
Northampton Street Ry	100	800,000	225,000	4 % A., June.	170	178
Omaha, Neb.–July 15						
Omaha Street Ry	100	5,000,000	5,000,000	3 % A. and N.	55	65
Paterson N. J.–July 15						
Paterson Ry. Co.	100	1,250,000	1,250,000	....	54	--
Providence, R. I.–July 15						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Oct.	109	110
Philadelphia.–July 15						
Fairmount Park Trans. Co...$50 pd.	50	2,000,000	1,770,000	2 %, Dec.	23	24
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15,	47	48
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	588,900	‡588,900	3 % S—July,	75	76
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1,	26½	27
Union Traction Co.......$12½ pd	50	30,000,000	29,980,450	....	30	30½
cElectric Traction Co.	50	....	8,297,920	....	--	...
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	345	--
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.	450	451
fLehigh Avenue Ry. Co.	50	1,000,000	....	....	48	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	90	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar.	300	...
cPeople's Traction Co.	50	10,000,000	†6,000,000	3 %, A., April,	...	--
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—	150	151
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan.,	151	152
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	...	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co.	50	30,000,000	‖20,000,000	$2 p. sh. Oct.	95	95¼
jCatherine & Bainbridge St.	50	....	‖400,000	6 % A—Mar.,	...	--
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July	158	157
Empire Passenger Ry. Co.	50	600,000	‖600,000	....	...	--
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July	208	208¼
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$8.50 share July	100	--
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July	308⅔	309
jPhiladelphia & Darby Ry. guar.	50	....	‖200,000	$2 share July,	...	--
j17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July,	--	--
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖885,000	$11 sh. A., July,	300	--
jUnion Passenger Ry. Co.	50	1,500,000	‖900,000	$9.50 shre, July	239	240
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July	262	268
Rochester, N. Y.–July 15						
Rochester Railway Co.	100	5,000,000	5,000,000	....	25	28
Reading, Pa.–Junly 15						
jReading Traction Co.	--	1,000,000	1,000,000	Semi-an., Jan. & Jy	24	26
kCity Passenger Ry	50	850,000	850,000	Jan.,	138	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan.,	70	--
St. Louis Mo.–July 15						
Fourth Street & Arsenal Ry	50	300,000	150,000	....	--	--
Jefferson Avenue Ry. Co.	50	400,000	400,000	2 % Dec.	--	--
Lindell Ry	100	2,500,000	2,400,000	1¼ % Jan.	--	--
National Railway Co.	--	2,500,000	2,479,000	1½ % Jan.	--	--
Cass Avenue & Fair Grounds	--	2,500,000	2,500,000	....	--	--
Citizens' RR.	100	2,000,000	1,500,000	4 %, Oct.,	--	--
St. Louis RR.	100	2,000,000	2,000,000	2½ %, Jan.,	...	--
Missouri RR.	50	2,400,000	2,800,000	1½ % Jan.,	--	--
People's RR. Co.	50	1,000,000	800,000	50c., Dec.,	--	...
United Electric Ry.........com.	50	500,000	500,000	....	24	25
United Electric Ry....... 5 % pref.	100	1,000,000	1,000,000	3 %, Jan.,	78¼	79
St. Louis & Suburban Ry.	100	3,000,000	2,500,000	....	90	93
Union Depot RR.	100	4,000,000	4,000,000	3 % A., July,	--	--
San Francisco, Cal.–July						
California St. Cable RR.	100	1,000,000	600,000	50c. monthly.	117	119
Geary Street Park & Ocean RR.	100	1,000,000	375,000	$2.50 share,	50	--
Market Street Ry.	100	18,750,000	18,750,000	Q., 60c. per share.	61½	68½
Presidio & Ferries RR.	100	1,000,000	550,000	....	--	16
Scranton Pa–July 15						
Scranton Railway Co.	50	6,000,000	2,500,000	....	29	30
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	16½	...
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	--	--
Springfield Ill.–July 15						
Springfield Consolidated Ry	100	750,000	750,000	....	--	--
Springfield O.–July 15						
Springfield Street Ry.	100	1,000,000	1,000,000	....	--	11
Springfield, Mass.–July 15						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	207	212
Toronto Canada.–July 15						
Toronto Street Ry.	100	6,000,000	6,000,000	1¾ % S.	109½	110¾
Montreal Street Railway Co.	.....	4,000,000	4,000,000	4 % S.	279	280
Washington, D. C.–July 15						
Belt Ry. Co.	50	500,000	500,000	....	--	--
Capital Traction Co.	100	‡12,000,000	12,000,000	65c. per sh, Oct.	103⅜	103⅞
Columbia Ry. Co.	50	400,000	400,000	6 % A.	--	...
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	35	40
Georgetown & Tenallytown Ry.	50	200,000	200,000	....	20	21
Metropolitan RR. Co.	50	1,000,000	458,900	2½ % Q.	--	--
Worcester, Mass.–July 15						
*Worcester Traction Co.........com.	100	8,000,000	8,000,000	....	32¼	35
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb.,	107	108
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %,	...	85
Wilkesbarre, Pa.–July 15						
Wilkesbarr & Wyoming Val Trac.	100	5,000,000	5,000,000	1%, Jan.,	25	26

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* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex-div.

a Leased to Hestonville, Man & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Company at a rental of $10,000 per annum in 1896-7-8, p. a. $20,000 in 1899-1900 and $30 000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6 % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Co., formerly Scranton Traction Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Boston, Mass.–July 15						
American Tel & Tel Co	100	50,000,000	28,650,000	4½ % Q., Jan.	154½	154¾
Erie Telegraph & Telephone Co.	100	......	......	1 % Q., Feb. 20,	48	48½
New England Telephone Co	--	10,394,600	10,304,600	$1.50 p. sh. Feb	141	141
New York.–July 15						
American Telegraph & Cable Co.	100	14,000,000	14,000,000	1¼ % Q	91	94
*Central & South Am. Teleg. Co.	100	6,500,000	6,500,000	1½ % Q.	100	105
*Commercial Cable Co.	100	10,000,000	10,000,000	1¾ % Q.	178	175
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	42	50
Erie Telegraph & Telephone Co.	100	5,000,000	4,800,000	1 % Q., Feb.,	--	--
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	108	109
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	116	118
Mexican Telephone Co.	100	2,000,000	......		2	2½
*New York & New Jersey Tel. Co.	100	5,000,000	3,728,000	2½ % Q., Jan.,	168	178
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	70	75
*Postal Telegraph Cable Co.	100	15,000,000	15,000,000	1 % Q.	--	--
*Sout'n & Atlantic Telg. Co. guar. 5 %	25	950,000	559,525	2½ % S.	95	00
†Commercial Union Telegraph Co.	25	500,000	500,000	3 % S., Jan.,	115	--
Western Union Telegraph Co.	--	......	97,370,000	1¼ %, Q, Jan.	89	89¼
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.–July 15						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q.	26	27
Bell Teleph. Co. (of Canada.)	100	3,960,000	3,564,000	2 % S.	188	--
Chesapeake & Potomac Telep. Co.	100	......	......	....	67	70
Chicago Telephone Co.	100	......	......	....	200	210
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	148	150
Empire & Bay States Telegraph Co.	..	......	......	....	75	76
Hudson River Telephone Co.	109	2,000,000	2,000,000	1 % Q.	120	125
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	122	125
Providence (R. I.) Teleph. Co.	50	......	......	....	96	99
Southern New Eng. Teleph. Co.	100	8,000,000	......	....	...	--

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.–July 15						
Fort Wayne Electric trust receipts	--	......	......	....	115	125
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	15	25
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	--	--
General Electric Co. [new]...... "	100	18,276,000	18,276,000	1⅓ % Q., Apr., 1901	245	245¼
T.-H. Elec. Co.-T. Secur., Series C.	--	......	......	....	22	28
Westinghouse Elec. & Mfg. Co. com.	50	......	146,700	....	70	70¼
Westinghouse El. & M'g. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q., Jan.,	75¼	76
Westinghouse El. & M'g. Co. rights.	50	11,000,000	8,195,126	......	1¾	1⅞
New York.–July 15						
Edison Elec. Ill'g Co., New York	100	9,188,000	7,988,000	....	119	120
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	2,000,000	1½ % Oct., '98.	--	--
Edison Ore Milling Co.	100	......	......	....	8	12
Electric Vehicle Co.............com.	--	......	......	....	--	--
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	--	...
General Electric Co. [new].... "	100	18,276,000	18,276,000	1⅓ % Q., Apr., 1901	245	245¼
Interior Conduit & Insulation Co.	100	1,000,000	1,000,000	....	41	--
‖ Kings Co. El. L. & P. Co.	100	2,500,000	2,500,000	A. & O.	110	125
Pittsburg, Pa–July 15						
Allegheny County Light Co.	100	500,000	500,000	J. & J.	168	172
East End Electric Light Co.	50	300,000	300,000	Q	--	--
Philadelphia, Pa.–July 15						
Edison Electric Light Co.	100	2,000,000	......	......	144	144½
*Electric Storage Battery Co..com.	100	8,500,000	......	......	75	--
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	75	--
Northern Elec. Light & Power Co.	10	550,000	550,000	......	13	13½
Southern Elec. Light & Power Co.	10	187,500	187,500	....	30	--
Miscellaneous.–July 15						
Bridgeport (Conn.) Elec. Lt. Co.	25	300,000	......	......	47	48
Missouri-Edison (St. Louis)....com.	--	......	......	....	20	21
Eddy Electric Mfg. Co.	25	......	......	....	9	12
Hartford (Conn.) Elec. Light Co.	100	850,000	......	....	190	191
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	6	10
New Haven (Conn.) Elec. Lt. Co.	100	100,000	......	....	195	--
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct.,	103	104
Rhode Island Elec. Protec. Co.	100	......	......	....	118½	120½
Royal Elec. Co. (Montreal)	--	1,000,000	......	2% Q	‡250	251
Toronto (Canada) Elec. Light Co.	100	1,085,000	1,085,000	1¾ % Q	136	138
Thomson-Houston Welding Co.	100	......	......	3 % S, Dec. 1,	--	100
Woonsocket (R. I.) Electric Co.	100	......	......	....	105	106

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

‖ Recently acquired the Edison Illuminating Co. of Brooklyn and its constituent company, the Municipal Electric Light Co.

ALLIED INDUSTRIES.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.–July 15						
American Electric Heating Co.	50	10,000,000	....	....	--	--
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh.	--	--
United Electric Securities Co...pfd.	100	......	1,000,000	$3.50 p. sh.	--	100
New York.–July 15						
Consolidated Electric Storage Co.	...	......	....	....	8	12
Safety Car Heating & Lighting Co.	100	......	....	......	150	155
Worthington Pump Co.........com.	100	5,500,000	5,500,000	......	--	--
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 % A	113	114
Philadelphia Pa.–July 15						
Electro Pneumatic Trans. Co.	10	1,500,000	......	--	2	2½
United Gas Improvement Co..scrip.	50	10,000,000	......	--	--	102
Welsbach Commercial Co.....com.	100	3,500,000	......	--	20½	21½
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	73	75
Welsbach Light Co.	5	525,100	......	....	54	55
Welsbach Light Co., Canada.	5	500,000	......	....	1	1½
Pittsburg, Pa.–July 15						
Carborundum Mfg. Co.	100	200,000	200,000	....	--	--
Standard Underground Cable Co.	100	1,000,000	1,000,000	Q	224	225
Miscellaneous.–July 15						
*Barney & Smith Car Co.......com.	100	......	1,000,000	--	20	25
*Barney & Smith Car Co........pfd.	100	......	500,000	2 %	120	129
Billings & Spencer Co.	25	......	....	....	82	--
Consol. Car Heating Co.	100	1,250,000	1,250,000	1½ % Feb	50	55
Johns-Pratt Co.	100	....	....	--	105	109
*Pratt & Whitney Co............com	100	......	....	--	--	
*Pratt & Whitney Co.............pfd	100	....	......	--	85	90
Stillwell-Bierce Co.............com	--	....	....	--	--	30
Stillwell-Bierce Co.............pfd.	--	....	....	2 % Sept	65	70
Shultz Belting Co.	--	300,000	....	....	80	90
St. Charles Car Co.		....	....	......	80	81

*Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany N. Y.

Date of Quotation—July 15 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry. Co......Cons. mtg. 5s	$500,000	427,500	1940	J. & J.	117½	......
†The Albany Ry. Co......Gen. mtg. 5s	750,000	875,000	1947	M. & N.	*116½	......
‖Watervliet Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*125	....
‖Watervliet Turnpike & RR..2d mtg. 6s	150,000	150,000	1919	M. & N.	*124	1 6
Troy City Railway Co....................1st 5s	....	....	1942	......	*116	117

†Interest guar. by Albany Ry. Co.

‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—July 15 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
United Electric Ry. Co...1st mtg. g. 4s	88,000,000	18,000,000	1949	M. & S.	102	102¾
" " " ....income 4s	14,000,000	....	1949	J. & D.	74¾	75
Baltimore City Pass. Ry..1st mtg. g. 5s	2,000,000	2,000,000	1911	M. & N.	118⅞	
†Baltimore Traction Co......1st mtg. 5s	1,500,000	1,500,000	1929	M. & N.	119	120
†Baltimore Trac. Co. Exten. & Imp. g. 6s	1,250,000	1,250,000	1901	M. & S.	104½	......
†Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	121	121¼
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s	750,000	....	1900	J. & J.	101	......
†Baltimore Traction Co. Convertible 5s	800,000	....	1906	N. & M.	102½	......
†Central Pass. Ry. Co.........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
†Central Pass. Ry. Co..Cons. mtg. g. 5s	604,000	580,000	1932	M. & N.	119	121
†City & Suburban Ry.....1st mtg. g 5s	8,000,000	8,000,000	1922	J. & D.	116	117
†Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	117	......

☞ All of the bonds of the above companies, marked †, have been assumed by the United Railways & Electric Company.

Boston Mass.

Date of Quotation—July 15, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s	5,879,000	3,702,000	1924	J. & D.	114	115
West End Street Ry.........Deben. g. 5s	8,000,000	3,000,000	1902	M. & N.	104½	106
West End Street Ry........Deben. g. 4½s	2,000,000	2,000,000	1914	M. & S	112	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation - July 15, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s	500,000	47,000	1906	J. & J.	....	....
†Charleston City Ry............1st mtg. 6s	850,000	....	....	J. & J.	106	....

†Controlled by Charleston St. Ry. Co

Chicago Ill.

Date of Quotation—July 15, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry..............1st mtg. 4½s	6,000,000	4,619,500	1901	J. & J.	101¾	2¾
‡Chicago Passenger Ry.......1st mtg. 6s	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s	4,040,000	4,040,000	1932	J. & J.	108½	109
Lake Street Elevated RR..1st mtg. g. 5s	7,574,000	8,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s	15,000,000	15,000,000	1942	F. & A.	96	96½
North Chicago St. RR.........1st mtg. 5s	8,171,000	8,171,000	1906	J. & J.	106	......
North Chicago St. RR.....Cert. indeb. 6s	500,000	500,000	1911	J. & J.	....	......
North Chicago City Ry.......1st mtg. 6s	500,000	500,000	1900	J. & J.	....	......
North Chicago City Ry.....consol. 4½s	2,500,000	2,500,000	1927	M. & N.	108	......
West Chicago St. RR..........1st mtg. 5s	4,100,000	8,969,000	1928	M. & N.	......	111
West Chicago St. RR.........Deben. 6s..	2,700,000	700,000	1911	J. & D.	101	102
West Chicago St. RR.....Con. mtg. g. 5s	12,500,000	6,000,000	1936	......	106⅝	107
‖W. Chicago St. RR. Tunnel..1st mtg. 5s	1,500,000	1,500,000	1909	F. & A.	....	....

†Redeemable at option on 60 ds. notice

‡Funded debt assumed by Chicago W Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR Co., lessee.

¶Subject to call after Oct. 1, 1899, at $110 and interest.

‖Assumed by W. Chi. RR. Co., lessee

‖Int. guar. by W. Chicago St. RR. Co

Cincinnati O.

Date of Quotation—July 15 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	8,000,000	2,500,000	1922	J. & J.	114½	115
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108½	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	114	......
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	581,000	581,000	1906	M. & S.	108¾	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	121½	122½
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	132¾	137

† Assumed by the Cincin. St. Ry. Co.

‖$250,000 reserved to retire 1st mtg. bds.

Cleveland O.

Date of Quotation - July 15 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co.......1st mtg. 6s.	600,000	600,000	1908	M. & S.	106½	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	8,000,000	2,500,000	1922	J. & J.	113½	114½
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	105½	106
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	8,500,000	1,249,000	1918	M. & S.	106	107
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	......	......
aEast Cleveland RR...........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	......	107½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.

‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—July 15, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry......1st mtg. 5s.	7,000,000	8,885,000	1905	A. & O.	......	102½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	877,000	1902	A. & O.	....	....
The Detroit Ry.................1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	105	106½

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—July 15 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918		111	....
New Haven (Edgewood Div.) 1st. mtg. 5s	250,000	250,000	1914	J & D	111	......
Winchester Avenue RR—1st mtg. g. 5s	100,000	500,000	1912	M& N	109	......
hester Avenue RR......Deben g	100 000	34,000	1915	M& S		

New Orleans La.

Date of Quotation—July 15 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR... cons mtg. 6s.	$150,000	$150,000	1912	M. & N.	......	.
Crescent City RR..............1st mtg. 6s	......	50,000	1899	M. & N.	105½	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	8,000,000	1948	J. & J.	......	.....
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	108	112
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1948	J. & J.	112	113
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	850,000	1907	F. & A.	......	......
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	......	......
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	......	......

†$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.

‡$90,000 outstanding.

New York

Date of Quotation—July 15 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	......
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107½	110
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	8,000,000	1,966,000	1931	A. & O.	115	116
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	123	125
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	105
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	108	110
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	115	116
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	101	....
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	......
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	8,500,000	8,500,000	1941	J. & J.	112	....
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	107	....
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	109½	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	98½	100½
Cent P'k, N. & E. R. RR. 1st cons. mtg. 4s.	1,200,000	1,200,000	1902	J. & D.	107	109
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	125	......
Coney Island & Brooklyn RR. 1st mtg. 5s	800,000	800,000	1903	J. & J.	101	103
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1932	J. & D.	117	120
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	100,000	1,100,000	1914	F. & A.	102	105
Eighth Av. RR. Co.....Cert. indebt. 6 %.	000 000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	,200,000	1,200,000	1910	M. & S.	116½	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	89	......
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	124	125
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	120	......
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	120	121
Second Avenue Ry...............Deb. 5s.	800,000	800,000	1909	J. & J.	108½	109
Steinway Ry. (L. I.).........1st mtg. g. 6s	1,500,000	1,500,000	1922	J. & J.	116	117
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	110½	11
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	......	12
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	.....	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	106	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	116
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	114

†$1,085,000 in escrow to retire gen. mtg. bonds.

‡$4,850,000 in escrow to retire maturing obligations.

¶$552,000 in escrow to retire 1st and 2d mtg. bonds.

§In treasury, $80,000.

‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—July 15 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.......................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry..............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M & S.	....	....

†$35,000 per m. single track authorized $600,000 in escrow to retire 6s due in 1901

Philadelphia.

Date of Quotation—July 15, 19

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry....................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry.....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry........Stk. trs. cert. g. 4s	5,698,210	......	1948	...	....	....
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J &	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s.	1,800,000	1,018,000	1917	F. & A	......	....
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry................1st mtg. 5s	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co..................Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	——	......
West End Passenger Ry....... 1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	......	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	......	......

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—July 15 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	111½	....
Central Traction Co...............1st mtg. 5s.	875,000	875,000	1930	J. & J	......	......
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	.....	......
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	110	113
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	113
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co.....................5s.	2,500,000	2,000,000	1934	J. & D.	......	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1912	M. & S.	......	....

Providence R. I.

Date of Quotation - July 5 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	116	118

St. Louis.

Date of Quotation—July 15, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baden & St. Louis RR.........1st mtg. 5s	250,000	250,000	1913	J & J	101½	102
Cass Ave. & Fair Gds Ry......1st mtg. 5s	1 818,000	1,818,000	1912	J & J	101½	102
Citizens' Railway Co.......1st mtg. 5s	2,000,000	1,500,000	1907	J & J	109	
Comp. Hts. Un. De. & Mer. Ter—1s	1 000 000	000 000	191	J & J	17	

With interest Unlisted

With interest

PASSENGER RAILWAY.

Name.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis. *Date of Quotation*—July 15 1901.						
Jefferson Avenue Ry......1st mtg. 5s.	270,000	270,000	1905	M. & N.	102	108
Lindell Ry. Co......1st mtg. 5s	1,800,000	1,800,000	1911	F. & A.	107	108
Missouri RR. Co......	1,000,000	700,000	1916	M. & S.	105	106
‖Mound City RR. Co......1st mtg. 5s.	400,000	300,000	1910	A. & O.	104½	105½
People's RR. Co......1st mtg. 6s.	125,000	125,000	1902	J. & D.	....	......
‖People's RR. Co......2d mtg. 7s.	75,000	75,000	1902	M. & N.	......	......
People's RR. Co......Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	......	......
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co......1st mtg. 6s.	2,000,000	2,000,000	1900	M. & N.	99½	100½
§St. Louis & Sub. Ry......1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry......Income 5s.	800,000	800,000	......	....	80	84
††Southern Electric Ry....Cons. mtg. 6s.	800,000	500,000	1909	M. & N.	106	108
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	300,000	1918	J. & J.	116½	117½
Union Depot RR. Co....1st cons. mtg. 5s.	1,091,000	1,091,000	1900	A. & O.	100	100⅞
Union Depot RR. Co......Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	121	122

†Controlled by St. Louis RR. Co.
‡Controlled by Union Depot RR. Co.
¶Controlled by Lindell RR. Co.
‖$300,000 in escrow to retire 1st & 2d mtg.
§$800,000 in escrow.
††$300,000 in escrow to retire 1st mtg. bds.

Name.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
San Francisco Cal. *Date of Quotation*—June 1901.						
California St. Cable RR......1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114	117
†Ferries & Cliff House Ry......1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	......	95
Market St. Cable Ry. Co......1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	126½	......
†Metropolitan Ry. Co......1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co......1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126½	......
†Park & Cliff House RR......1st mtg. 6s.	350,000	350,000	1912	J. & J.	105½	107
†Park & Ocean RR......1st mtg. 6s.	250,000	250,000	1914	J. & J.	115	......
†Powell St. Ry......1st mtg. 6s.	700,000	700,000	1912	M. & S.	.....	125
Sutter St. Ry. Co......1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......

†Controlled by Market St. Ry. Co.

Name.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Washington D. C. *Date of Quotation*—July 15, 1901						
Belt Ry. Co......Cons mtg 5s.	500,000	450,000	1920	J. & J.	......	
Columbia Ry......1st mtg. 6s.	500,000	500,000	1914	A. & O.	128	......
Eckington & Soldiers' Home 1st mtg. 6s.	200,000	200,000	1911	J. & D.	......	......
Metropolitan RR. Co.....Coll. tr. cons. 6s.	600,000	500,000	1901	J. & J.	......	......

†$50,000 in escrow to retire 1st mtg. bds.

Name.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation*— July 15, 1901						
Bridgeport Traction Co......1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	108	110
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	118	.. ..
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	104	107
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	112	113
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	115	
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	111¼	111⅝
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	115	115½
Denver City Cable Ry......1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	20	..
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1932	A. & O.	80	85
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	119	119½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	110¼	110¾
††No. Hudson Co. Ry. (N. J.).Cons. mtg. 5s	8,000,000	2,878,000	1928	J. & J.	108	......
No. Hudson Co. Ry. (N. J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	....	......
Rochester (N. Y.) Ry......1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	......	......
St. Paul City Ry......Cons. g. 5s.	5,500,000	4,298,000	1937	......	105½	106
St. Paul City Ry......Deb. g. 6s.	1,000,000	1,000,000	1900	......	108	....

†$1,000,000 in escrow to retire 1st and 2d mtg. bds.
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.
¶$760,000 in escrow to retire bonds of C. O. St. RR. Co.
‖$67,000 in treasury.
§$900,000 res'ved to redeem prior liens
††$620,000 in escrow.

*With int're

ELECTRIC LIGHT AND ELECTRICAL MFG. COS

Name.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass. *Date of Quotation*—July 15, 1901						
Delaware Gas Lt. Co.,......1st m. 5s, g.	800,000	800,000	......	J. & J.	106	10·
Edison Elec. Illuminating Co., Boston...	2,026,000	......		Quar.	157	...
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	116	....
Pittsburg Pa *Date of Quotation*—July 15 1901						
Allegheny County Light Co......6s.	500,000	......	1911	J. & J.	110	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(July 5 1901.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	109	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1998	......	124	......
Edison Elec. Illg. Co. (Brooklyn).......	5,000,000	5,000,000	1940	....	122½	124
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	. ..	......
Kings Co. El. Lt. & Pow. Co. 1st mtg. 5s.	2,500,000	......	1937	A. & O.	100	105
Kings Co. El. Lt. & Po. Co. pur. money 6s	5,176,000	....	1997	A & O.	120	122
Milwaukee El. Ry & Lt. Co. 1st con. g. 5s.	8,000,000	....	......	F. & A.	102½	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Name.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation*—July 15 1901.					100½	101
American Bell Telephone......4s.			1908	F. & A.	......	....
Northwestern Telegraph Co......7s.	....	......	....	......	....	......
N. Y. & N. J. Telep & Tel'g Co. gen. mtg. 5s	......	......	....	......	114	115
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	103	106

ALLIED INDUSTRIES.

Name.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation*—July 15 1901						
American Electric Heating...... 7s	500,000	500,000	....	....	....	......
Armington & Sims Engine Co......	....	....	......	......	......	25
Barney & Smith Car Co......6s.	....	....	1942	J. & J.	106	107
Carborundum Mfg Co......6s.	....	....	1904	J & D.	......	......
Worthington Pump Co......	75,000	....	......	......	115	127

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 16⅞@17c.; Lake, 17@17⅛c.; casting, 16⅝@16⅞c.

Richmond, Va., has refused to grant a franchise to the Bell Telephone Company.

The People's Light and Power Company, capital $1,500,000, has been incorporated in New Jersey.

R. G. Dun & Co., report failures for June as somewhat heavier than for the three preceding months.

The Westinghouse Company has a contract to equip the Antwerp, Belgium, Steel Company with electric power.

A committee headed by Emerson McMillin has formulated a reorganization plan for the Lincoln (Neb.) Gas and Electric Company.

The Edison Electric Illuminating Company of Boston has declared a regular quarterly dividend of 2½ per cent., payable August 1 to stock of record July 18.

A Chicago dispatch says that the directors of the Central Union Telephone Company will meet July 31, to consider plans for raising $8,000,000 new capital.

It is reported that the June earnings of the subsidiary companies of the Massachusetts Electric Companies aggregated $550,000, which is an increase of about $50,000 over June, 1900.

Subscriptions to American Telephone and Telegraph Company new stock are payable August 1 and January 15, payments on these dates being for full shares equal to one-half of shares subscribed for.

It is reported that the Jersey City, Paterson and Hoboken Street Railway Company has secured control of the North Hudson County Railway Company and that the two companies will soon be consolidated.

The syndicate that will build the electric railway between Syracuse and Utica, N. Y., has been organized and the other preliminaries have been completed. The Standard Oil Company is reported to be behind the scheme.

The British Electric Traction Company, Limited, one of the pioneers of electric traction in the United Kingdom and the largest concern of its kind in that part of the world, will soon be controlled by J. P. Morgan interests.

The annual report of the Chicago Union Traction Company, which will be presented to the stockholders at the annual meeting on July 23, will show a small surplus after the payment of fixed charges and the $150,000 paid on the preferred issue.

The following are quotations for some of the industrial stocks not quoted elsewhere: Electrical Lead Reduction, 1½@2½; Electric Boat, 14@16; Electric Vehicle, 9@10; Tel. & Tel. Company of America (full paid), 4@6¼; Electric Company of America, 6⅞@6¾; National Carbon, 16½@16¾.

The recent strike of the Union Traction Company in Albany, N. Y., Troy, Waterville, Cohoes and Rensselaer cost the company $50,000. This became known on Saturday last when the board of directors met in Albany and declared a dividend of 1¼ per cent. In order to do this, the loss of revenue and expenses during the strike having been so great, the directors were compelled to draw on the surplus funds.

A syndicate, headed by Oakleigh Thorne, has virtually consummated the consolidation of the Poughkeepsie (N. Y.) Gas and the Poughkeepsie Electric Light Companies, with a capitalization of $1,000,000. The members of the syndicate hail from New York and Pittsburg, Pa. Negotiations are now pending by which the same syndicate will gain control of and consolidate the Newburg, N. Y., gas and electric light corporations.

A syndicate composed largely of Boston people has organized the Hartford and Springfield Street Railway Company to connect the two cities of Hartford and Springfield by electric road. The new road will be 25 miles in length and will enter Springfield over the tracks of the Springfield Street Railway Company, and enter Hartford over the tracks of the Hartford Street Railway Company, advantageous arrangements having been made to effect such entrance. The capitalization of the new company will be $375,000, 5 per cent., 20 year bonds, and $375,000 stock. All the securities have been placed.

The Philadelphia "Stockholder" of Monday, says: "Last week's announcement of a semi-annual dividend of only 25 cents per share on Electric Company of America stock, instead of the usual 50 cents per share, not only explained recent weakness in the stock, but was disappointing to those who had been led to infer from President Snowden's open letter, a few weeks ago, in which he stated the company could pay 50 cents per share and carry a substantial amount for the surplus account, that there would be no change in the dividend rate. Another presumable explanation for extensive liquidation in the stock was rumor of a prospective call of $2.50 per share, in pursuance of a plan, it was said, to make the stock full-paid, on a basis of $10, or possibly, of making par $50 by exchanging one share of new stock for five shares of the present issue. The latter plan is said to have met with the approval of a number of large stockholders, but whether a majority of the stock would assent to this or other plans of similar character is still an open question. In view of the showing made in the annual statement, wherein the company is shown to have a fund of $900,000 cash in hand, it has been suggested in certain quarters that a plan be formulated which will provide for crediting something on the stock, say, $1.25 or $1.50 per share, and for the calling of a like amount, instead of $1.50 per share. The only plan which has as yet been even informally considered is said to provide for a reduction in the capital stock from $25,000,000 to $5,000,000. Meanwhile, those who bought their stock in the twenties occupy the unenviable position of seeing the price gravitate below 7, and the dividend rate cut in half—conditions not conducive to make the stock appear very attractive at the moment."

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THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

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EDITORIAL NOTES.

The Brooklyn Bridge Traffic Problem.

The problem of transporting quickly and safely the large number of persons who desire to cross the Brooklyn Bridge during the morning and evening "rush hours" is one that has proven most difficult to solve.

That something will have to be done in the near future to alleviate the congestion of traffic is only too apparent to anyone who is unfortunate enough to have to cross to and from the City of Churches by way of the bridge.

The new East River Bridge when completed—which, however, will not be for some time to come—will undoubtedly tend to help matters, but probably not to any great extent, and in any case something needs to be done at once. A number of schemes have been suggested, such as enlarging the terminal facilities and running more cars, and although this might prove satisfactory for the time being, the question arises as to whether the bridge can stand the weight of many more cars without being overloaded.

In this connection it is interesting to note that an army engineer by the name of Hill suggests remedying the crush evil by means of an electrical moving sidewalk, resembling in many respects that made use of at the recent Paris Exposition. His plan consists in having a continuous and perpetually moving electrical platform, with seats at the back. Four lines of these sidewalks would occupy each of the two floors of the bridge. After leaving the entrance half of the cars would follow the "L" tracks and the others the trolley tracks. As the distance across the bridge is about a mile there would be eight miles of continuously running platform. Mr. Hill refers to his suggestions as follows:

"To operate the electrical sidewalks will require but a minimum of power and give the maximum of carrying capacity. It will also distribute the load equally throughout the bridge and abolish the present unequal weights, and particularly the heavy strains on the bridge caused by the sudden stopping and starting of heavily loaded trains and cars.

"It is proposed at first to run the electrical sidewalks at a moderate rate of speed, say six miles an hour continuously. To make it perfectly safe and easy for children and aged persons to get 'aboard,' a series of little platforms moving alongside at graduated speed, each a little faster than the other, will be provided so that before one is aware of it, almost, he finds himself on the main platform moving across the river the same as if he were in a car—surprised and delighted at finding plenty of room and a comfortable seat, all the while gliding rapidly over the big bridge as if by some magic process.

"Each of the present tracks occupied by two of the moving sidewalks, and traveling in opposite directions over the river, will be under cover, with windows on either side, affording light and air and the same incomparable view of the city, the river and the bay as now."

Mr. Hill claims, and apparently with reason, that a load thus distributed evenly across the bridge would strain it far less than the present system of heavy trains at intervals. He says:

"It is estimated that the weight of the trucks and machinery now necessary for the present cars will almost equal the weight of the entire eight lines of electrical sidewalk, together with its covering, stretching clear across the river, saying nothing of the hundreds of heavy cars and extra big emergency cables that are so great a weight on the bridge.

"The power will be supplied by the electrical system now in use, but a large number of dynamos will be placed at intervals across the Bridge beneath the moving sidewalk, making breakdowns and consequent delays by the failure of one or several of the dynamos impossible, as the other dynamos will be sufficient to keep the sidewalk moving at the usual speed.

"The approaches to the upper tracks at the terminal in New York and Brooklyn will be by a similar system of propulsion—by escalators, to save ladies from having to climb stairs, as they do now under protest, and often with serious results if invalids."

Mr. Hill estimates that "each of these electrical sidewalks can easily carry ten thousand persons per hour, making eighty thousand passengers per hour for the eight lines of moving sidewalk.

"Thus during the two rush hours of an evening—from five to seven o'clock—a hundred and sixty thousand people can glide over the bridge without crowding or danger.

"I estimate that the expense of the system, including its operation, will be much less than the present system. I estimate that it can be put in for less than half a million dollars, against the millions recently named for the proposed improvements to do away with the overcrowding at the terminals."

The plan suggested would seem a reasonable and practical one, and in view of this fact it might be well for the proper authorities to examine closely into the matter.

* * *

Our Trade With Scotland.

The American electrical industry will be glad to learn that the Scotch trade in electric motors for operating coal mines and heavy engines for electric power stations, of American manufacture, is assuming more commercial importtance each year, and that the market which is being gained is not experimental or temporary, but sound and permanent, subject only to the ordinary fluctuations of trade. The business done rests on a substantial basis of a growing preference for American electrical machinery, and trade built upon this foundation is likely to endure, if prices and quality continue satisfactory.

Electrical manufacturers who may be inclined to look upon Scotland as a possible market for their products should bear in mind the fact that, generally speaking, to sell a Scotsman anything he is not familiar with involves a clear demonstration of its merits. As to a number of American articles now in common use in Scotland, this process has been slow and somewhat expensive in the past, but a reputation once gained, a manufacturer has a devoted and profitable customer in a Scotsman, a customer who spends his money freely for what he wants, although he will not take as a gift anything that does not suit him. It is this phase of the Scottish character, plainly shown in all transactions in the business world, that has convinced many of the necessity for manufacturers and exporters to consider that commercial trend as something apart from England, to be especially cultivated if they would obtain the best results. This policy has been pursued for a number of years by an increasing number of American firms, and to the new departure may be largely ascribed the advance we have made and are making in Scotland.

* * *

The Park Avenue Tunnel.

It looks very much as though the New York Central Railroad will shortly be obliged to substitute some other power for steam in its tunnel, which leads out of New York. The matter has grown so serious that it is possible that it may be taken before the Grand Jury.

There are three railroads—the New York Central, the Harlem and the New York, New Haven & Hartford—whose trains use the Park avenue tunnel. Every day over 500 locomotives, and about 3,000 cars, besides switching locomotives, pass through it. The volume of gases, steam and smoke emitted by the locomotives is greatly in excess of the ventilating facilities. As a result during the warm weather the heat and foul gases in the tunnel, reach the limit of human endurance.

Furthermore, residents of Park avenue complain that their apartments are filled with smoke and cinders, and that the value of their property is consequently depreciated.

The New York Central has been at work trying to solve the problem for some time. The great difficulty lies in the fact that the traffic is so heavy. Were it not for this there would be no difficulty in installing the third-rail electric system, as is made use of by the Pennsylvania road in hauling its trains through the Baltimore tunnel.

That electricity as motive power will eventually have to be resorted to by the New York Central there is little doubt and in fact it is claimed that plans are being perfected for operating all trains leaving the Grand Central Station by electricity as far as Yonkers and possibly beyond that city. It is also asserted that trains of the New Haven road will also be propelled in a similar manner at least as far as Mott Haven. As the Brooklyn "Eagle" recently said the New York Central is a progressive railroad and it forestalls compulsion in this matter. By concessions it makes friends. It also shows the way to all the other railroads in the land toward the abolition, or, at least, the mitigation of a nuisance affecting residents and travelers alike. When the terrors of tunnels disappear, more people will be content to live in the country, the crowding of the cities will be relieved and healthful enjoyments will be more freely opened.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

MR. W. C. HAWKINS, formerly with the General Electric Company at Schenectady, N. Y., has been appointed general manager of the light and power departments of the Electric Light Company and the Cataract Power Company, of Hamilton, Ont.

◆

THE annual meeting of the Indiana Independent Telephone Company's Association will be held in Lafayette July 29 and 30. It is reported that this will be the largest meeting thus far held by any State Association. There will be papers upon subjects of vital interest to telephone people, and displays will be made by the leading telephone manufacturers. There will be reduced hotel rates, headquarters being at the Lehr House.

◆

THE following press dispatch was sent from Chicago on Saturday: "Chicago students of electricity have invented a wireless telegraphic system which overcomes many difficulties in the Marconi system. The three collaborators are Prof. Clarence E. Freeman, of Armour Institute; Dr. L. De Forrest, lately of Hartford, and Edwin H. Smith, of the Western Electric Company. The inventors declare that their system gains over the Marconi method at both sending and receiving stations. The sender, which is worked out from a theory evolved by Prof. Freeman, makes no use of the induction coil. In its place is a condenser, which, beside being less bulky than the sending cabinet with induction coil, liberates energy with greater speed. The receiver, which is the joint invention of Dr. De Forrest and Mr. Smith, aims to receive signals from the sending station as fast as the operator can work the key. Heretofore fifteen or twenty words a minute has been the best speed attainable by wireless telegraphy."

◆

NEARLY all the villages in the Adirondacks are now lighted by electric lights and the majority of the hotels in the interior have private electric plants. This has led to the lighting of many private camps by electricity, and there is much talk of consolidating these power stations for the purpose of operating an electric road, the demand for which is considerable.

◆

ON the afternoon of July 18 forty-eight electrical contractors, representing business interests in the States of New York, Missouri, Pennsylvania, Maryland, Michigan, Ohio and Minnesota, met in the New York State Building at the Pan-American Exposition and organized the National Electrical Directors' Association with these officers: President, Charles Eidlitz of New York; vice-presidents, G. M. Jones of Minnesota, E. T. Cook of St. Louis and H. K. Mackay of Baltimore; treasurer, George R. Mathieu of Pittsburg; secretary, W. H. Morton of Utica. A board of directors having ten members was also elected. This board will decide the time and place of the next convention.

◆

THE Manila electric light plant, which is now under course of extension, is to be equipped with cooling tower, condensers, pumps and heater apparatus, having a capacity of 2,500 hp. This equipment will be furnished by the Wheeler Condenser & Engineering Co., of this city. A large steel stack for the power house is to be shipped by the Philadelphia Engineering Works, of Philadelphia. These contracts were placed by the American electrical engineering and contracting firm of Bagnall & Hilles, whose headquarters are in Yokohama, with branch establishments at Singapore and Manila.

◆

FROM Houghton, Mich., comes the report that the Calumet & Hecla will shortly complete the structural portion of a new six stamp mill each stamp is to be fitted with an individual electric motor of 25 hp.

◆

THE Automobile Club of America held an important meeting in this city last week. which was attended by about 40 members, and over which Vice-President Albert C. Bostwick presided. The principal object of the meeting was the passage of several amendments to the constitution and to discuss the affiliation of the various automobile clubs throughout the country in a united effort to secure State and Federal legislation in the interest of good roads. It was decided to hold a convention, to which all the automobile clubs of America will be invited to send delegates, and at that time action will be taken regarding the legislation above outlined.

◆

AN improvement in the Reuterdahl storage battery, has been made by Arvid Reuterdahl of Providence, R. I., says a local paper. At the bottom of the glass or rubber retaining jar are wedge-shaped supports of acid-proof material, which is not a conductor of electricity. These support the composite plates and provide space underneath for the acid. Each plate has two parallel flexible side pieces or holding plates of thin sheets of hard rubber or celluloid, which have many small perforations. The electrode is a lead top bar with depending ribbons, which constitute the active material and extend out in close parallel strips. Strips of wood are placed between the holding plates for spacing purposes, and the top bar of the electrode is inserted between the plates at the top for the same object. Rods of non-conducting material pass through the holding plates, which are kept spaced by washers on the rods. Notches on the bottom of the plates prevent displacement. Each electrode has an upward projection, and these projections are connected by two bars having the combination previously used in storage batteries. The construction described is said to reduce weight and size, to afford elastic support for the active material and to lessen the liability of short circuits.

◆

AN Italian paper states that one M. G. Trouvé has devised a method of obtaining effects from an ordinary fountain comparable to those of an electric fountain. He uses glass beads, rice, small celluloid balls, etc., and a jet of air blown by a centrifugal pump as a means for keeping them in motion. When these objects are projected through a jet by the stream of air and illuminated, magnificent effects are said to be produced.

◆

THE Western Society of Civil Engineers announces that through the generosity of one of the members it is enabled to state that three medals will be awarded for the best papers presented by the members in 1901; one in civil engineering, one in electrical engineering and one in mechanical engineering. Further details will be announced at an early date.

◆

IT is learned that there will soon be between Moscow and St. Petersburg a railroad with electrical traction or power. The trains will run at the rate of 240 versts an hour, it is said. The verst is less than one mile. The whole distance between the two cities will be covered in two and one-half hours. The above mentioned railroad is based upon the principle of that between Berlin and Hamburg, the project adopted by the German Government, and which is to be built by Philippi & Gabriel, the inventors of the new system. The two German cities are separated by 260 versts, and the price of the tickets will be three times lower than that of the steam railroad. Another electrical line, as they call it there, will be constructed between Finland and St. Petersburg by the Stoila Company.

◆

A DISPATCH from London says that articles of incorporation of the company formed by Mr. Charles T. Yerkes for acquiring the old underground railroad and changing it into an electric line have been filed. The American directors include Mr. Yerkes, Mr. Parsons of the Union Traction Company of Philadelphia, Brown Brothers, bankers, of New York; Mr. T. Jefferson Coolidge, M. Ayers, Mr. Rogers of the Standard Oil Company, and Mr. Mitchell of the Illinois Trust Bank. The capital is $5,000,000, of which $1,680,000 belongs to Mr. Yerkes.

◆

ROENTGEN rays sometimes give rise to mortification of the skin, and medical men have frequently been prosecuted in consequence. When the tubes are driven by influence machines that does not happen, but then the activity is reduced, and the presence of moisture and the necessity of an earth connection may be awkward. R. Demerliac has found, according to an article in "Comptes Rendus," that tubes worked by alternate currents of high frequency and high tension never produce erythema, and that, on the contrary, the rays so obtained possess the curative properties recognized in electrotherapeutics, since the experiments of d'Arsonval, Oudin, Doumer and others. He, therefore, employs the Oudin resonator, which, with certain precautions, may be made to work X-ray tubes. They light up on connecting them with the upper knob of the apparatus. A broad concave cathode and a small anode or an annular anode are used. The cathode is joined to the resonator, and the anode may be left free or put to earth. The discharge is most effective when it proceeds in one direction only. A cathode valve should, indeed, be useful. The tubes may be brought quite close to the skin without risk, and thus any loss of penetrative power is effectually counteracted.

◆

THE Crown Mountain Gold Mining Company of Dahlonega, Ga., is now making use of electricity in the working of its plant. This mining company is preparing to work the ores of Crown Mountain, within one mile of the court house at Dahlonega. The difficulty heretofore has been lack of water to sluice out the ore, but the company has solved the problem. Twelve miles distant there is a good fall on the Chestatee River. Here an electric power plant was erected. A pump station was placed on the bank of the Chestatee at the foot of Crown Mountain and a 10-inch pipe line was laid to a reservoir at the summit, a mile distant, and 560 feet higher. The reservoir has a capacity of 750,000 gallons. The triplex pump, propelled by electricity, conveyed by wire about 12 miles from the power plant, easily forces 1,500 gallons of water per minute up and into the reservoir.

◆

ONE of the interesting features of the exhibits in the Electricity Building of the Pan-American Exposition is a typical electric locomotive of the size and kind used in the coal mines of the Union Pacific Railway. In fact, after the exposition closes this very locomotive that is exhibited will be sent out West for service in the coal mines there. The weight of the locomotive is ten tons, and it is made for thirty-inch gauge and for operating on 500-volt circuits. So clever is this little machine built that the controller, brakes and the sanding devices are all operated and controlled from one point, where the operator sits. In looking over the construction, one of the details which attracts practical mining men is the removable brake shoes, which may be quickly removed and replaced without affecting any other part of the brake gear. The little locomotive is fitted with headlights and all of the modern appliances which go to make up a complete outfit.

◆

FROM what has been learned about China in recent years the conclusion lies uppermost that while Chinese engineering has proceeded quite successfully along static lines, it has rested for centuries without progress in all that involves motion, says "Cassier's Magazine. Thus, while their fixed structures are notable and frequently beautiful, their machines for doing work and moving people and goods are rudely primitive. The curious Chinese wheelbarrow is still a most important factor in land transportation, but what in the United States, for example, is considered very modern "cage construction" for buildings, has been practiced by the Chinese for centuries, and is found all over China. This is one of the many interesting observations made by Mr. William Barclay Parsons during a railroad survey in 1898, and recorded in his recent book entitled "An American Engineer in China."

THE Chicago Automobile Club members propose to wrest the world's record from Fournier early in September. Fournier's record was made on a run from Paris to Berlin, and so far is the leading automobile performance of the year. During the second week in September, however, the Chicago Automobile Club will make a journey to Buffalo, and the run is expected to be a race against time, with a view to taking the laurels from the Frenchman.

◆

A NOVEL explanation of ball-lightning, a phenomenon familiar in the tropics, is offered by Mr. Hesechus, a German electrician, who has recently been interesting himself in the subject, says the "Electrical Engineer," London. He has come to the conclusion that this electrical display is due to the combustion of masses of nitrogen, and he has devised an apparatus by which, with the aid of an alternating 1,000 volt current and a vessel of water, he can give a fair reproduction of the phenomenon.

◆

IT is reported that the output of the Lake Superior copper mines was less for the calendar year 1900 than it was for the year 1899. The difference is stated at 5,346,525 pounds, or about 2,673 short tons, of refined copper. Though the decrease from the Lake Superior mines has been considerable, there is no reason to doubt that the product of all the mines in the world was greater last year than ever before. A quarter of a century ago most of the copper produced in North America came from the Lake Superior mines. At present those mines, though they yield far more than they did then, supply less than one-thirty-fifth part of the North American product. The great increase in the world's output of copper began simultaneously with the use of electricity as a motive power. We are indebted to the enormous increase in the supply of copper for the extensive use of electricity for the propulsion and traction of vehicles. The supply of copper, though increasing, is not keeping pace with the demand, which bids fair to increase at a still greater rate in the future and for an indefinite period.

"New Electrical Terms."

Our contemporary, "Lightning" of London, calls attention to the following electrical terms as described in an English gazette:

BATTERY.—A primary battery is one in which electricity is obtained through the decomposition of metals in electrical solutions.

BRUSH.—The copper string which connects with the commutator of a dynamo and gathers the electricity for the conductors.

CORE.—The iron that becomes magnetized in an electro-magnet. In helix this iron is of the softest kind.

DYNAMO.—Machine for converting mechanical power into electrical energy.

NEGATIVE.—The terminal of a generator, where the positive current returns after traversing the circuit. Negative electricity is an amount less than the substance would naturally contain.

POLARITY.—A magnet suspended so that its movements are unrestricted in any direction, and will turn one point to the north and the other so the south. Hence the north and south poles of the magnet.

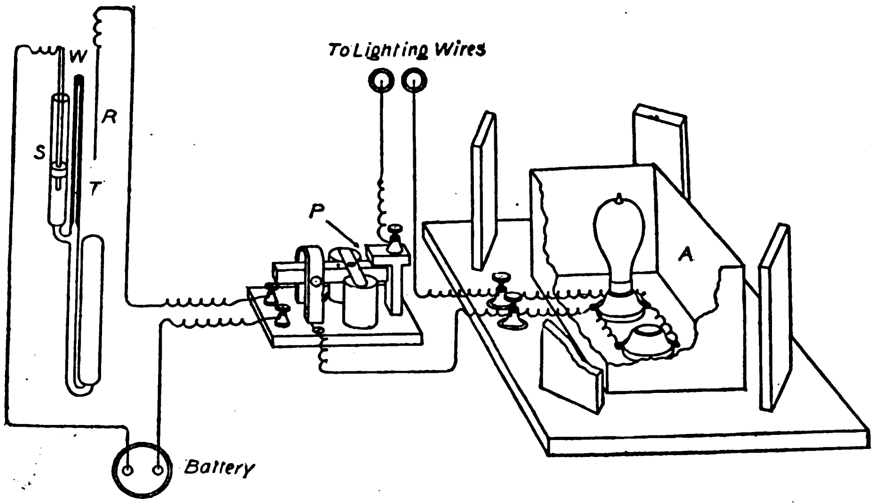
There are two new units given—the "jule" and the "ferad." Methinks, says our contemporary, the special contributor is one of those practical electricians who graduated first in the school of plumbing and bell-hanging.

AN ELECTRICALLY HEATED AND ELECTRICALLY CONTROLLED THERMOSTAT.*

BY S. W. YOUNG.

I recently found myself, on account of a very irregular and inferior gas supply, forced to devise some other means than the one usually employed for heating and regulating the thermostat. After a few preliminary experiments the apparatus herein described was developed, and has, after considerable experience, shown itself to be thoroughly satisfactory—in many respects more satisfactory than the usual form with gas heating.

For this latter reason it seemed worth while to publish a brief description of the apparatus in the hope that use might be made of it by others. As will be readily seen, the principle allows of very ready application to thermostats for biological laboratories, such as are used for the purpose of maintaining constant temperatures in paraffin baths for imbedding, etc., and for incubators and the like. Some forms of the apparatus for these purposes are being tested and, if successful, will perhaps be described elsewhere later.



The apparatus consists of four essential parts: (1) the bath (not shown in diagram); (2) the heater; (3) the interrupter; (4) the regulator.

1. The Bath.—This may be of any desired form. For my purposes, I used a cylindrical agate ware can covered with felt. The capacity was about 30 to 35 liters. The general arrangement of the bath is identical with that of the usual Ostwald thermostat and needs no further description.

2. The Heater.—This consists of a square board of convenient dimensions, upon which near the center are screwed two or more incandescent light receptacles, which are wired up parallel, as usual. Surrounding these is an asbestos box open at top and bottom, which serves to economize heat. For heating purposes incandescent lamps are used and have been found very satisfactory for low temperatures, although it may be questionable whether they would prove sufficiently durable at higher temperatures. For maintaining my 30-liter thermostat at 25° C., I have found that one 16 cp. and one 8 cp. 100 volt lamp acting together were wholly sufficient. The four uprights at the corners of the base board serve as supports for the bath.

3. The Interrupter.—This I made by the reconstruction of a telegraphic sounder. The wiring of the current to the lamps is so arranged that when the armature is raised the current passes through it and the lamps remain lighted. When the armature is pulled down the current to the lamps is interrupted at P, and the lights go out. It goes without saying that platinum contacts are preferable.

4. The Regulator.—This is a modification of the ordinary form of the gas regulator. The principal modification lies in the side tube S. This is provided with a piston carrying a stout iron or platinum wire W. In filling the regulator, it is so arranged that the whole space below the piston is filled with mercury and a layer of mercury is placed on the top of the piston. This allows: (1) connection between the mercury of the regulator and the battery cell; (2) it allows of the regulation of the height of the mercury in the capillary tube T, by raising and lowering the piston. In this way the regulator can be set for any desired temperature. The piston may be made of a piece of cork, fastened to the wire by cement. There is no particular difficulty in making such a piston mercury tight. Finally the wire R is so arranged that it can be placed at any desired height in T. It serves to complete the circuit through regulator, battery and interrupter when, by warming, the mercury shall have risen in T to such a height that contact is made with R. It also serves for the final, exact regulation of the temperature.

The action of the whole apparatus is then as follows: The bath is placed over the heater and the regulator in the bath, which must naturally be mechanically stirred; the current is turned on through the lamps which warm the bath; this warming expands the mercury and toluene in the regulator, until finally contact is made between the wire R and the mercury in T; this closes the circuit through the battery and interrupter, drawing down the armature of the latter and interrupting the current through the lamps; cooling follows, the contact between the mercury and R is broken and the current again made through the lamps. Thus the temperature in the bath is maintained constant to within small limits. In general the temperature of my thermostat never varied more than from two to three-hundredths of a degree. By taking special precautions (avoidance of draughts, etc.), I have been able to avoid any variation greater than one-hundredth degree for over four hours. Temperature variations were noted with the aid of a Beckmann thermometer.

I should like to state here that, from my experience with thermostats, I have been convinced that the fineness of the regulation of the temperature demands not so much sensitiveness, i.e., large linear motion for small temperature change in that part of the regulator where the cut off is, but rather rapidity of response on the part of the expansive medium to temperature changes. In the ordinary bulb regulator, the lag of the expansion and contraction of the toluene is the most fruitful source of variation, when the sensitiveness of the regulator has been otherwise highly developed. This defect is to be best met, not by increasing the quantity of expansive liquid, but by distributing it in such a way that there will be greater surface exposed, i.e., in annular or spiral bulbs. I have made no experiments in this direction as the apparatus above described was wholly sufficient for my purposes.

Certain modifications of the above apparatus will naturally suggest themselves, such as use of platinum wires instead of lamps, etc., but the apparatus as described has worked so satisfactorily that I have let well enough alone.

Certain advantages, such as affording no danger from fire, cleanliness, etc., need not be enumerated here.

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*From "Jour. Am. Chem. Soc."

MISCELLANEOUS NOTES OF INTEREST TO CENTRAL STATION MEN.—II.

BY W. H. WAKEMAN.

Where an old lever safety valve on a boiler is to be replaced by a pop valve, it is not necessary to make the new one the same size as the old one, because the improved type is much more efficient than the old fashioned valve, therefore a smaller size will answer every purpose.

It is seldom that a lever valve is found on a boiler that will prevent the pressure from rising after it begins to open. A pop valve opens to its full capacity so quickly that there is little chance for an increase of pressure, provided the valve has an area of one square inch for each three square feet of grate surface.

If a boiler compound is used to remove old scale from a boiler and it does its work well, there is great danger of the boiler being injured by it, therefore the engineer in charge should watch it with special care. It may have been the custom to clean boilers once each month, but when the compound begins to work it will loosen the scale, as well as dissolve it, and as the hard pieces cannot be blown out through the blow off pipe, they accumulate on the fire sheets, and may prevent water from reaching the metal, causing it to be burned. Under such conditions the manhole cover should be removed once each week, and all loose scale taken out. I have seen 34 quarts of loose scale in a medium sized boiler, that had been thrown down by the use of a compound, and thus became more dangerous than when it was clinging to the tubes. The next time that this boiler was opened it contained 30 quarts of loose scale. These two lots amounting to 2 bushels were thrown down within the time that it was customary to allow the boiler to go without cleaning, therefore if the same plan had been followed after the compound was used the fire sheet would have been bagged by the heat, and the damage would have been charged to the scale remover, or in other words it would have been condemned, because it did the work for which it was used.

When crude oil is used for this purpose it sometimes works into the joints, takes out the scale and dirt, making the boiler leak. It should be commended for this, but frequently it is discontinued, because it is claimed that the boiler is injured by it. As a rule this is a mistake, for a boiler should be tight when clean, and if the removal of scale and dirt exposes defects we should be glad to know the true condition of affairs, even if it does make repairs necessary.

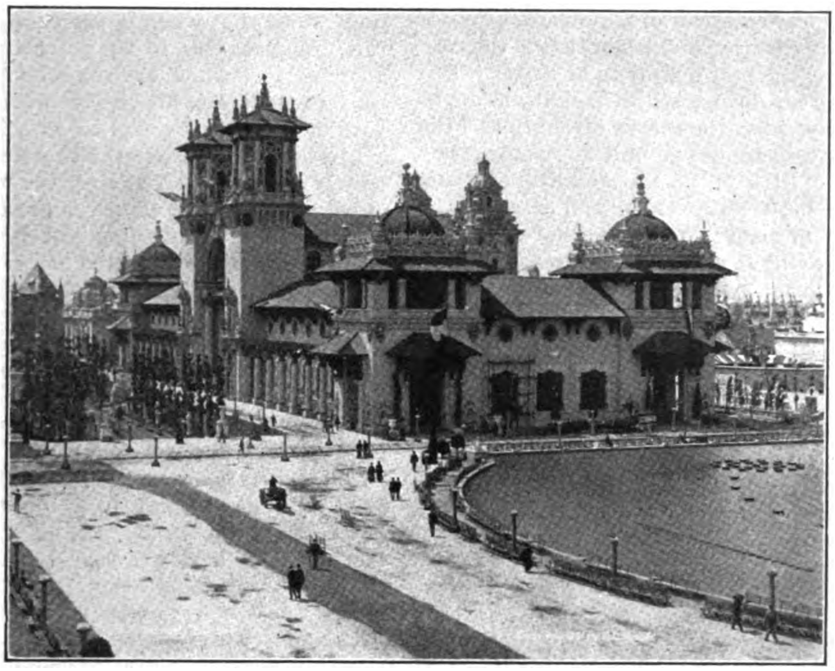

FIG. 1.—ELECTRICITY BUILDING (DAYTIME) AT THE PAN-AMERICAN EXPOSITION.

It is sometimes quite difficult to get all of the old packing out of the stuffing box of a valve stem, or a piston rod, but when it has been in use long enough to get hard and allow steam to leak by it, every piece of it should be removed. Do not take out a part of it and then put in one or two rings of new packing on top of what is left, for while that may stop the steam from escaping, it makes it necessary to screw the gland down harder than it would if all of the packing was new, and this may cause the stem or rod to be scored.

Many of the large valves now furnished us have deep and narrow stuffing boxes, so that it is difficult to get the last ring of old packing out, but it is still advisable to remove it. On the last job of this kind that I had the bonnets of the valves were taken off, and the stems removed from them in order to make a clean job of it. This made some extra work, but it was a source of satisfaction when finished.

Some engineers keep their old oil cans of various kinds in plain sight in their engine rooms, but the object sought in so doing is not clear to us. Some of them are of no use, and none of them are ornamental, therefore it would look better if they were put in the cellar out of sight. A neat engine room is much more creditable than an untidy one, and people are much inclined to judge an engineer by the appearance of his engine room.

Plug cocks and gate valves usually answer a very good purpose on water pipes, but where it is desired to throttle the supply for any cause, they are not as convenient as a globe valve of improved design, and when they leak it is more difficult to repair them. A globe valve is not always desirable because the crooked passage through it causes a loss of pressure in the supply. There is usually an ell somewhere near the desired location of a valve, and if an angle valve is put on in place of this ell it will not create extra friction, and it possesses all the advantages of a globe valve.

It may not be necessary to keep the gauge cocks on a boiler in use every hour, as a well kept glass gauge is reliable, but they should be raised often enough to keep them in good order, for if a glass breaks they may be wanted at short notice.

On general principles it pays to put in an economizer and heat the feed water as hot as possible before it enters the boiler, but under some conditions it may not be a paying investment, and these should be investigated before one is installed in a plant. If the temperature of the products of combustion as they escape to the chimney is 700 or 800 degrees, and the feed water is going into the boiler at 110 or 120 degrees, there is a chance to save much heat.

ELECTRICITY BUILDING (NIGHT) AT THE PAN-AMERICAN EXPOSITION.

On the other hand if the gases are reduced to about 350 or 400 degrees, and the feed water is raised to 212 degrees, there is not so much chance for an economizer to pay for itself. This refers to a plant already in use, but when a new plant is to be erected it is well for the designing engineer to determine which will be the cheaper, to put in an economizer or add enough heating surface to the boiler to take up the surplus heat.

We are told that if the furnaces of our steam boilers were supplied with the proper quantity of air to produce complete combustion, and no more, we should secure much better results from the fuel used, and this is probably true, but when we study up the theory of the combustion of coal we find that there is a very extravagant claim made for the simple act of getting the right quantity of air, and if these results could be realized in practice it would revolutionize the business. A good fireman can save enough coal to pay his wages (where he fires several boilers of medium size) by attending to his duties in an intelligent manner, but if it was possible for a good one to evaporate as much water with 5 tons of coal, as a poor one can with 10 tons, steam users would soon find it out.

PAN-AMERICAN SCENES AND EXHIBITS.—II.

BY FRANK C. PERKINS.

The attendance at the Pan-American Exposition is rapidly increasing as the vacation season approaches and there is no doubt but that it will be a great success in every particular. The color effects are most beautiful by day while the soft mellow light of the system of incandescent lighting makes a charming night scene. The accompanying illustrations, Figs. 1 and 2, show the Electricity Building by day and the same view by night, the lights reflecting in the fountain basin in front of the Electric Tower. There has been some criticism of the bunches of lamps on the posts, as too near the line of vision and too bright but the general effect is entirely satisfactory. The 25 cycle alternating current from Niagara seems to answer the purpose of decorative lighting admirably, although a number of prominent engineers thought it would be too low a frequency to give the best results. The General Electric exhibit is one of the most prominent, being located at the northeastern end of the building and includes in its display the 19 air cooled transformers, of 250 kilowatts capacity each, with the necessary switching apparatus, for controlling all of the decorative lighting on the grounds. These transformers were illustrated in ELECTRICITY, May 22, No. 20, page 313, Vol. XX. This group of transformers in the Electricity Building, Figs. 1 and 2, receives the power from Niagara Falls at 11,000 volts after passing the regulating and starting rheostat described in the previous issue, and is transformed down to 1,800 or 2,000 volts for distribution to the various transformer pits about the grounds. At these transformers the current is again reduced to 104 volts, making three transformation processes after reaching the city limits before supplying the lamps and motors with energy. The first transformation being from 22,000 volts at the Ontario sub-station, where the Niagara Line terminates, to 11,000 volts on the circuits leading to the grounds.

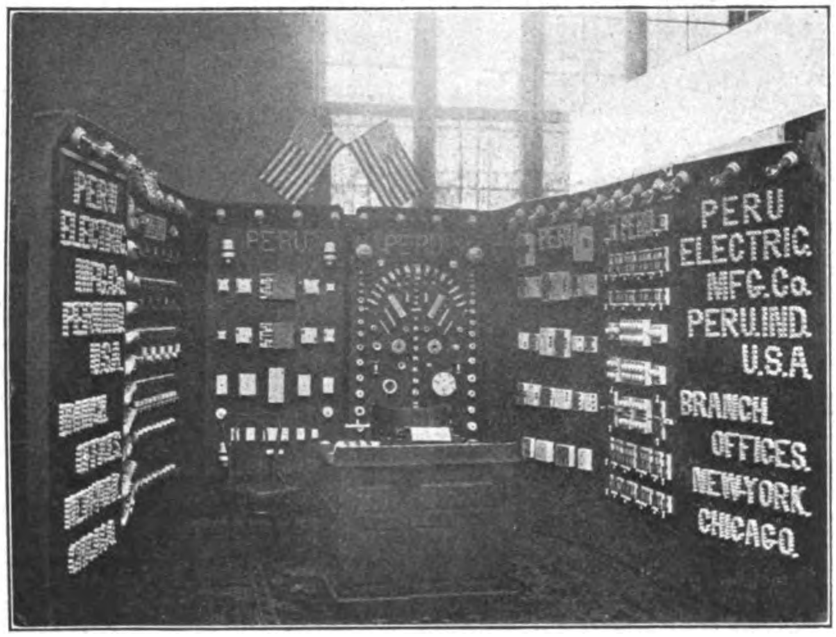

FIG. 3.
Peru Electric Company's Insulator Exhibit at the Pan-American Exposition.

The 11,000 volts main line switches leading to these air blast transformers are of a new type, electrically operated three pole oil break switches, and are the same in construction as those employed in the power house and sub-stations of the Manhattan Elevated Railway in New York.

The 18 transformers have their secondaries at 1,800 volts, all connected to a common set of bus-bars, and from these bus-bars a dozen sets of three-phase feeder circuits are connected for distribution to the various buildings. Each of these circuits has an indicating wattmeter and a three pole oil switch.

The accompanying illustration, Fig. 3, shows the porcelain exhibit of the Peru Electric Manufacturing Company of Peru, Ind. It presents a full line of cut-outs, baby knife switches, rosettes, receptacles and other specialties well known to the trade.

The next issue will show a recent day and night view of the Electric Tower, with its magnificent fountain basin in full operation, while the exhibit illustration will be that of the American Telephone Company of Chicago.

IMPORTANCE OF LITTLE THINGS IN RAILWAY TELEGRAPHY.*

BY THOMAS D. LOCKWOOD.

Let us consider the conductor first. This may be regarded as including the line and office wires. Ninety cases out of a hundred, at least, the line wire is iron; and when that is the case the joint is the part mainly to be looked after. If I should lay down a set of conditions about the grade of wire, the tensile strength and the maximum resistance per unit of length, they would be of little or no use to anyone having their wire delivered to them; and being in the condition of having to take this wire or no wire, or having to accept wires already strung. But it is never too late to attend to joints. After many years of considering and using joints in iron wire, and after careful comparison of the regular twist joint of the United States lineman and the Britannia joint, I feel free to say that I think the twist joint, soldered, is the better of the two, all things taken into consideration. For it is not only simple to make, but holds well, is comparatively easy to solder and leaves no projecting points. The short projecting ends of the Britannia joint would, I think, on our lines be productive of trouble, as tending to hook neighboring wires, thus introducing crosses. But unquestionably, iron wire joints ought always to be soldered, at least when the wire is first strung, and I believe in a general soldering campaign at intervals, say, of three years. Such a practice would tend to economy alike in battery power, time in operating and profanity.

Copper is a thing apart. The twist joint, in my opinion, ought not to be employed with it, nor should copper joints be soldered. There is too great a risk of burning the wire. Either the two-sleeve McIntire joint or the three-wire joint should be employed. And while it seems a thing that every one stringing copper wire ought to know, it is a fact that every one does not know, that in the attachment to insulators of copper line wires, copper tie-wires must be used.

The glass insulator seems to have become standard with us, and in a country generally so dry as is ours it is probably good enough. I think it is a question, however, whether carefully tested porcelain insulators would not, along the coast and for some 50 miles inland, be a material improvement. But it is to be understood that when I say porcelain insulators, I do not refer to the porcelain door-knob abominations which are sometimes—I fear far too frequently—used by constructors of a saving turn of mind.

I have sometimes seen office wires festooned loosely and carelessly all over the wall, instead of being properly stretched and neatly secured. This is only a little thing, but it proves that the wireman who connected them was a careless and neglectful man, who will some day be sure to cross-connect a main with a local circuit, or perform some like enormity. I have even seen bare wire used on the walls and tables of an operating room for office wire. Where but a single wire enters an office, as good a way as any is to screw up porcelain picture-hanging knobs on the walls, and to run the office wire from knob to knob as far as the switchboard or cut out, tacking it the rest of the way. In tacking, a poor wireman will be under a strong temptation to put two wires under one staple, but that particular temptation must always be resisted.

A young and enthusiastic operator naturally likes to have his table present a tasteful appearance, and even spends money from his own all too scantily filled pocket to buy an oilcloth cover for the table on which the instruments are to be placed. The wireman comes and connects the instruments all right, but there is an escape or partial cross in that office which, until removed, sadly interferes with the working of the line. I think it likely that others here, besides myself, have introduced a trouble by means of a painted or oiled table cover to which the key was screwed; and while the desire to have a neatly arranged office is laudable and to be encouraged, oilcloth covers for instrument tables are to be looked after and generally discouraged.

This brings us to the consideration of instruments. Beginning with lightning arresters, so-called (although since lightning was never known to be arrested by anything, the term seems to be a misnomer), I think that there are still a good number in use of the old-fashioned style, wherein a piece of paper or similar poor conductor is placed between two plates having conductive relation with the line and ground respectively. A little thing to be looked out for in these is a fault not infrequently occurring after a lightning storm. The operator sees a bright flash, and hears a sharp crack as of a pistol shot, but as his relay is not burned out he thinks that no harm is done. But an escape has appeared on the line which presently is located in his office; and it is then found that a spark has perforated the paper and that a partial contact has been established through the carbonized edges of the perforation between the line and the ground plates. After the flash and crack of course this should have been looked to.

In operation also we can well look after small matters. I have known reputable operators to adjust with a very slack armature spring, and a distant magnet; others to adjust almost together by a magnet screw; others again who prefer a moderately slack armature spring and a moderately distant magnet. Yet, although I have found many who did not know it, the best results, as is evident by applying intelligent thought, are to be attained by working with the magnet as close to the armature as can be arranged without taking the chance of straining the latter; to adjust the limit stops so that while the armature is thus close it can never absolutely touch the magnet cores; to keep the magnet adjustment generally permanent; to have a highly adjusted armature spring, and as far as possible to adjust altogether by such a spring. For when this is done, we make the most of whatever current is on the line and thus get a snappy forward attraction, while the tight spring gives an equally sharp reaction. Any temporary readjustment can be much more effectually done by adjusting the spring than by changing the position of the magnet.

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*Read before the Railway Telegraph Superintendents' Association, June 20, 1901.

Sometimes a relay otherwise good will exhibit signs of residual magnetism, and will thus become difficult of adjustment. A very little change will often remedy the effects of this phenomenon. This is to transpose the main wires and relay binding screws, so that the direction of the current through the relay winding is reversed.

In the matter of batteries, we may surely assume that at stations where there are main batteries, there must always be some one of requisite skill to look after them; and that we may therefore restrict our considerations to local batteries. The care of these, of course, should be understood by every operator, but, alas, it is not.

Often a local battery is allowed to remain without attention far too long, and is at last only taken apart, cleansed and renewed because it is unable to work any longer. When disconnected, if it be one having porous caps, it is found that the substance of the cup in a number of places is plugged or filled up with crystalline copper, and that the porousness is, to a corresponding extent, impaired. It is well to remember in setting the battery up again that these copper incrustations and deposits may be prevented in a new cup, and diminished in an old one, by the simple expedient of so placing the zinc that it shall not touch the bottom or sides of the cup.

In batteries—local batteries in particular—it frequently happens that the connections or screw clamps between the cells are allowed to oxidize, or to become covered with crystalline accretions; this last in the case of potassic bichromate batteries especially, and the crystals in such batteries, being chrome alum, are non-conducting and insoluble.

Every operator at every station, however important or unimportant, should know when and how to take a battery to pieces, and how to clean it and set it up again. I fear that all operators do not. Every operator should know that in a blue vitriol battery the solution of zinc sulphate should be strong enough, but not too strong; and that the current is unduly weak, both when the zinc solution is too weak and when it is too strong.

When gravity batteries are used and there are no covers to the jars, there is a very great tendency to evaporation. When I first worked with gravity batteries I was told this, and was also told that to counteract such tendency a layer of crude cotton-seed oil must be poured over the top of the zinc solution. But crude cotton-seed oil is a most abominably filthy article; and after thinking the matter over I decided to try melted paraffin in its place. This answered the purpose admirably, quickly solidifying in a thin covering over the liquid. But it is too dear for general use, and I presently found that tallow makes a very good substitute. It prevents evaporation, and when the cell is to be cleaned the film of tallow can with ease be cut cross and round, and taken off in two or three pieces; exactly as a cook would remove flakes of congealed fat from the surface of cooled soup.

Sometimes a LeClanche cell with sealed porous cup will not work at all satisfactorily. It seems as though the cup, though really porous is utterly impervious to the battery fluids. When this happens, it is probable that the vent holes in the sealing have been stopped up. This being so the remedy is to run a pointed iron or steel rod, such as a fine screw-driver, through the holes into the mixture so that the gas can escape. But if the so-called porous cup be really too hard or glazed it can be made to work by boring several holes through its sides.

ELECTRIC TIME SERVICE.*

BY F. HOPE-JONES.

Perhaps in no department of our complex modern civilization are the evils of individualism so apparent as in the glaring anomalies of our numerous independent clocks. The present system (or want of system) will not bear a moment's examination even in theory, and, as everyone must admit, stands self-condemned in practice.

It cannot even plead the selfish utility of individual umbrellas, for they at least shelter their owners, even if the drippings do go down someone else's back. Whereas truth requires it to be said of even the best independent clocks that they do not really supply a uniformly accurate indication of time to those who purchase them, while the opinions of those who rely on them making their appointments, catching trains, and correcting their watches, must not be recorded here—at least, not in the original language.

Absolute accuracy of time-keeping is impossible of attainment; even the most perfect clocks in our observatories, with carefully compensated steel and mercury pendulums inclosed in air-tight cases in which the barometric pressure is kept constant, and placed in special buildings with walls 3 feet thick to keep the temperature even, will usually be found incorrect, if two or three cloudy nights in succession have prevented a reading from the "clock" stars. How then can we expect to obtain accuracy from the ordinary mantleshelf clock, with its short pendulum and the quality of its works so often made subservient to the ornamentation of the case?

The more one thinks of this, the more one is forced to the conclusion that mere improvement in the quality of clocks generally used, or, if you like, a determination to buy only the best, will not prove a satisfactory solution of the matter, as their errors are in any case cumulative, but that it is necessary to strike at the root of the whole evil, viz., their individuality and independence of control.

Now the breakdown of the independence of clocks is presumably to be accomplished by the communication of a common impulse to them What agents are available for connecting a number of dials together so that their hands may revolve synchronously?

(1) Mechanical connection has been employed in some large railway stations, where leading-off rods with beveled gearing enable one clock to control the hands on dials widely separated; but this method has obvious limitations in practice, as it can operate only within a very restricted area.

(2) Pneumatic devices have been used for the purpose in Paris, where impulses of compressed air operate a number of dials on handsome iron standards at the carrefours by the "Popp" system.

(3) Electricity, however, provides far the best means of disseminating small impulses over a wide area. If proof of this is needed it is supplied by the evolution of the common household bell, which has passed through the same three stages of mechanical, pneumatic, and electrical connections, and survives in the latter form alone.

Incidentally the superiority of electricity for this purpose has been attested by the experience of the last sixty years. It is a remarkable fact that the idea has been entertained since 1840, since the earliest days of telegraphy, and that electricity has been hailed by all inventors as the one means of securing uniformity. The subject of electric clocks was played with in rather a desultory fashion by the greatest inventors of the nineteenth century, yet the extent to which the systems of each have been introduced is as nothing when compared with the vast field for their operations.

As an indication of the importance of the problem, I may mention that Alexander Bain, Sir Charles Wheatstone and Lord Kelvin are among the many inventors who have devoted time and thought to its solution. In view of the ability such names represent, it would almost seem presumptuous for me to rush in where angels fear to tread! but it is only by careful study and criticism of previous failures that one can arrive at their causes and avoid them. Such a study enables one also to discover the essentials of the problem and to dispense with much needless mechanism. A vast amount of ingenuity has been expended upon inventions which could never yield fruitful results, and among such I would prefer in this article to pass by without comment all forms of clocks which merely go without being wound up, which, though using electricity as their motive-power, retain their individuality and independence, and so neglect the greatest service which that agent can render.

Broadly speaking, there are but two methods of obtaining unanimity in a number of dials: (1) correcting or synchronizing complete clocks of the ordinary kind by means of an electric impulse transmitted to them periodically, and (2) dispensing with the clock works, and directly propelling the hands by means of such impulses transmitted at short intervals.

The former—correcting or synchronizing existing clocks—has been accomplished by applying electro-magnetic attachments to the lower ends of their pendulums, controlled by a master clock making tacts every second, and also by fitting an electro-magnetic clip to the minute-hands, so that an hourly impulse from the master clock will forcibly pull them into synchronization.

The pendulum controlling method is in use in many observatories, and is known as the "Ritchie Sympathetic Pendulum," from the firm of Messrs. James Ritchie & Son, of Edinburg, who have made it a specialty, though the credit of the original invention should be accorded to Mr. R. L. Jones, a former station master of Chester, who devised it in 1858.

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*Abstract from "Feilden's Magazine."

The minute-hand clip was invented by Mr. J. A. Lund in 1878, and has been established as a public service in London by the Standard Time Company, Ltd.

But in whatever way synchronizing currents be applied, the complete key-wound clocks are retained, the line wire being merely used to correct their cumulative errors, and consequently the obvious question forces itself upon us—why not use electricity to directly propel the hands of a number of clocks, so dispensing with their works and the necessity of winding them up?

The idea of simply rotating a number of clock hands synchronously without the use of complete and independent sets of clock-works is so fascinating in itself and so obviously the most simple, direct, and efficient method, that it is the only class of electric clocks which we consider really worth discussing, and this article will be devoted to it.

Let us then clear our minds of all ingenious devices for obtaining perpetual motion, of pendulums swinging beat for beat under the influence of electro-magnets, and of synchronizing attachments which only add mechanism to clocks already sufficiently complicated, and consider de novo what is essential to be done and the simplest way of doing it.

At the outset we have the choice of exhibiting numerals as in a railway time-table, or of using the ordinary circular dial. For the former we would require three drums or canvas bands for displaying the numerals, and the unit figures must be moved every minute. Now this mechanical movement is not so easily accomplished as the rotation of a pointer, and even if it were so I believe that the old-fashioned way is the best, and that the figure method, although championed by many of our American cousins, will never become popular.

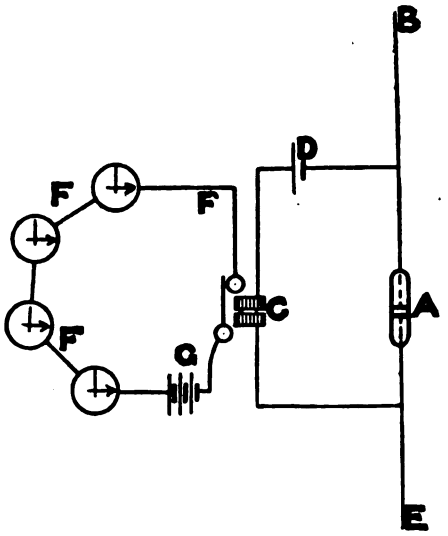
All that we require, then, is the face and hands of an ordinary clock, and in the pursuit of ideal simplicity we must look upon anything else that may be wanted beyond these (for the purpose of revolving the hands) as a necessary evil. The works of the household clock of to-day consist of a pendulum, an escapement, and seven wheels. These are necessary for the measurement of time, and for the storage of power to move the hands throughout the whole week, and if these duties are to be performed separately in each individual clock no less amount of mechanism will suffice.

But with the help of electricity both the measurement of time and the supply of power to revolve the hands can be provided in one spot, and communicated to any number of dials within a reasonable distance. For the former we shall use one central pendulum only, instead of separate pendulums in every clock, and for the latter we shall use one small battery of Leclanché cells instead of a train of wheels in each clock.

Thus are the clock-works dispensed with, and in their place each dial is provided with a single wheel, a lever, and and an electro-magnet, the whole constituting an electrical step-by-step movement which revolves the hands half-a-minute at a time in response to impulses sent out from the one controlling pendulum. In conclusion, it only remains for me to refer to an ideal system of uniform clock control which the development of wireless telegraphy seems recently to have placed within our reach.

The method by which this could be almost universally applied to the distribution of time impulses will be too obvious to our electrical readers to require explanation; but for those who have not followed the recent developments in space telegraphy, we show its application to clocks in diagrammatic form.

The receiver consists of a coherer A connected to earth at E and to a vertical aerial conductor at B. In circuit with it is a relay C and a small primary battery D. Normally, the resistance of a coherer is such that the circuit is practically open; when, however, it is within the sphere of influence of electrical oscillations produced by high-tension sparking between earth and a vertical aerial wire, the resistance falls and the relay operates.



Clock Driving by Wireless Telegraphy.

F F F represent a number of the step by-step dials we have described, grouped in a separate circuit with their own battery G, and governed by the relay C. It is obvious that this circuit can readily be operated by "wireless" signals transmitted at regular periods, suitable arrangements being, of course, made for the tapping of the coherer and for securing single contacts of sufficient duration.

Probably there were others to whom this idea occurred when Marconi's achievement startled the scientific world, but it was original with the writer, and he considered it in all its bearings in 1899 in conjunction with Mr. Isaac H. Storey, of Lancaster, who conducted the first experiments in this direction with one of the dials described, and has since operated a circuit of them continuously. Mr. Richard Kerr, with the assistance of Mr. Leslie Miller, also exhibited one of them at the Royal Society's conversazione in May last year, and their demonstration attracted much attention.

To see a number of dials grouped round a wireless transmitter is to see visions of an aerial pole erected by the London County Council on the Nelson Monument in Trafalgar Square, which would thus become a central station for time distribution for the Metropolis. Then no more would accurate time be a luxury of the rich, dispensed by the clockmakers at high prices, but would be as free as the air we breathe.

Until recently this dream seemed impossible of fulfillment, owing to the liability of the time receivers to interference from other electrical oscillations in the neighborhood, either transmitted deliberately for telegraphic or other purposes, or unintentionally from the starting and stopping of large electrical machinery. The latter might have been overcome, but it was hardly to be hoped that ether telegraphy could be reserved for the sole purpose of controlling clocks. This was all the more to be regretted because the inability to confine and direct the transmitted impulses to any one receiver, which was a fatal bar to its use for general telegraphic purposes on land, would become a positive virtue when the system is used for the dissemination of time, for we no longer require privacy between sender and receiver. The message, "This minute has expired; let all clocks hitch on another tooth," coded into a single dictatorial impulse, would radiate in all directions from public transmitters in the center of every town.

Now, however, that Marconi can tune or syntonize the wireless system, and so prevent interference; now that the savants at the Society of Arts have actually discussed (at his lecture this month) standard "frequencies" for Admiralty and Post Office use, the idea of universal State-supplied time signals almost enters the arena of practical politics. Whether the public appreciation of such a boon would justify an Act of Parliament making it a criminal offence to produce electrical oscillations of the periodicity specified by the Board of Trade as exclusively to be used for clocks, is open to doubt, but we can at least prepare a way for it by the adoption of local time-circuits in accord with some such system as we have described, and the gradual abolition of the separate and independent time measurement of individual clocks. Let us only be careful that our endeavors are directed into the right channel, lest our work be superseded when ether telegraphy and the Government are ready.

Of one thing I am certain, that whatever the future may have in store for us in the way of universal time "transmitters," there can be no doubt as to the ultimate form of the "receiver" clocks. They will be mere indicator dials driven by a simple form of step-by-step movement in electrical connection.

Big Electric System.

Cleveland, July 23.—All the electric railways in this vicinity and the Everett-Moore syndicate are to be merged into one big corporation, capitalized at $150,000,000.

Henry A. Everett and E. W. Moore, of Cleveland, are the projectors of the scheme, and they have secured a great deal of New York, Philadelphia, Boston and Detroit capital. The system is the first great electric system in the world. The plan has been to secure city systems and build connecting suburban links.

Over 25 different city and interurban lines have been acquired and gathered together to make up this great system. It includes the city lines in Port Huron, Mount Clemens and Detroit, Mich., and in Sandusky, Lorain, Cleveland and Akron, Ohio, and the interurban lines connecting them. The system already completed forms a belt almost around Lake Erie, from Port Huron, Mich., to Buffalo, N. Y., with lines reaching southward from the lake toward Cincinnati, Wheeling, W. Va., and Pittsburg.

The mileage already completed and in operation in this system amounts to 1,215, while over 400 miles of additional track are under construction and will be completed within the next year.

The total earnings of the separate companies that comprise this huge system already amount to over $10,000,000 a year. It is estimated that these earnings will increase enormously after the roads have been connected and united under one management.

TECHNICAL EDUCATION IN EUROPE.*

BY JOHN M. BARR.

The education of the European engineer begins much earlier than is the custom with us and the primary schools are in many respects superior to ours. The primary teachers are for the most part men of a high degree of intelligence, and consecrate their lives to their profession. From the start the children are led to take an active interest in their work, not that this implies any lack of discipline, for, if anything, the discipline in the European primary schools is more rigid than in our own. The studies are made real, however, and anyone who has read the little monologues in the German reader on plant life or rocks, or on similar subjects, cannot but be impressed by the beautifully clear and simple manner in which the matter is treated. Thus we see that the best teachers and the best writers devote themselves to the children and arouse in them the spirit of investigation which will be so useful to them in after life. The Europeans seem to be of the opinion that nothing is too good for the scholars in the way of solid early preparation, an opinion with which the writer heartily agrees.

As a consequence of this training the students enter the "Gymnasium," which corresponds to our high school, with an interest in their work, and with an accurate conception of the meaning of the simpler physical laws. The training in the high school is quite severe, and the work in mathematics is especially good. In fact, the graduates have a working knowledge of the integral and differential calculus, and what is of greater value, they have a good physical conception of the idea involved. When we consider that this is rather more than can be said of our average college graduate, we may at once appreciate that here is one department of our educational system, which suffers by comparison. Whether the better grasp be due to a greater amount of time spent upon the subject, or to better methods of instruction the writer is unable to say, but the fact remains that to these youngsters the calculus is like a tool ready to be used and used correctly when needed. Each operation means something real, has a physical significance. The writer feels fairly safe in saying that to the average American student, the physical significance has to do with the weary hours spent in carving integral signs, or the labor involved in carrying the textbook to and from classes. As time permitted, the writer attended some lectures upon this subject in Zurich, and they were in the nature of revelations. The application to physical laws was constantly referred to, every point gone over in detail and made perfectly clear. As a result of the Gynasium training the students entering the German university have the advantage of the best possible training in mathematics, and the first year is devoted largely to review, though some higher work is taken up.

The University course does not differ materially from our own. The same general subjects are taken up, but the mathematical treatment is very complete, and very much more generally employed than in our engineering institutions. The students are well in position to grasp the work when treated in this manner, and the method has in its favor thoroughness and elegance. The work is all given in the form of lectures with written reviews at certain intervals. The lectures are written up at night, and the time required of the student is about the same as under the textbook system.

At the end of the sophomore year, in addition to the regular semestral examinations, is held a so-called ubergang examination, which covers all of the work taken up during the first two years, and students who are successful in this examination are eligible to the work of the last two years. The semestral examinations continue through the last two years, and before a degree is conferred the student is obliged to pass a final examination covering the four years' work. The examination is partly written and partly oral, and is generally quite severe.

The laboratory work is an important adjunct to the lectures, and here the points brought out in the lectures are taken up in detail. The writer was surprised at the amount of time that the professors spent in the laboratories personally supervising the work. A striking feature in this connection is the small amount of attention given to the rapidity with which the work is turned out. If the work is done well, and understandingly, the time involved is never thought of. This fact explains, in a measure, the excellence of the technical data compiled in Europe; for our motto, "Time is money," is fatal to the success of work of this character. The instructors in the laboratories are generally men studying for a higher degree, and, as a class, were quite efficient.

Engineering trips are made during the semester to the factories and plants in the neighborhood of the school, and during the spring vacation a longer trip is made. The trip last year was to the exposition at Paris, and the details were quite like our inspection trips. Each professor took with him a certain number of students, and together they inspected the various exhibits and discussed them in detail.

The writer is often asked: "Are the European technical schools better than our own?" It is hopeless to enter into a discussion upon this point. There are so many conditions which are foreign to us affecting the character of the technical schools in Europe that to discuss this matter intelligently would involve an immense amount of study. Food, climate, social and trade conditions, and above all, the character of the European people are all prominent factors in the problem. It is by no means certain that the character of training best suited to make a successful European engineer would meet American requirements. There are some differences, however, which the most casual observer cannot but notice, and these the writer gives without comment:

First—A much better preparatory training than we find in America.

Second—The slow, methodical character of the German student, with an entire absence of our impatience in arriving at results, making a longer and perhaps more thorough treatment possible.

Third—A much more mathematical treatment of engineering subjects, and

Fourth—A much closer relation between faculty and the student body than in America.

The European countries are most liberal, so far as education goes, and many of their best thinkers have devoted themselves to the solution of the educational problem, and the writer feels that whatever the faults of the European system, when one considers the many celebrated names among the graduates of European schools, one cannot but feel that the European system at least needs no apology.

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*From the "Wisconsin Engineer."

CANADIAN NOTES.

Messrs. Charles R. Whitehead, David A. Pringle, Robt. E. T. Pringle, Francis H. Leonard, Jr., and Edward E. Cary, all of Montreal, Que., are seeking incorporation as "The Ampere Electric Manufacturing Company," with a capital of $50,000. The headquarters of the company will be in Montreal.

The agreement between the city of Ottawa and the new Consumers' Electric Company has been completed, and the company has deposited $5,000 with the city treasurer as a guarantee. One of the conditions of the agreement is that the company shall be in a position to supply lights to the extent of not less than 10,000 lamps within a year, otherwise the deposit will be forfeited to the city, and the company's franchise will lapse.

It is said that a Marconi wireless telegraph tower will be erected in the city of Montreal, Que., for experimental purposes, in connection with the river shipping and other important interests. The position has not yet been definitely chosen, but the top of the great Northwestern Telegraph building will probably be selected as the site.

The probability is that the Montreal Electric Street Railway will reduce its rates in the near future, at least so far as the fares for workmen are concerned. Instead of eight tickets for twenty-five cents, as at present during certain hours of each day, the likelihood is that ten tickets will be given for that sum. The company may also extend the time during which these tickets may be issued and used. This decision is the outcome of a request made by the city authorities that something should be done to make workman's transit cheaper.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended July 11:

Antwerp, 102 packages, $3,003; Argentine Republic, 235 packages, $26,841; Australia, 376 packages, $20,531; Berlin, 2 cases, $750; Bilboa, 57 cases, $4,223; Brazil, 1 case, $208; Bristol, 9 cases, $1,000; British East Indies, 55 packages, $2,911; British Guiana, 4 packages, $136; British West Indies, 8 packages, $98; Central America, 34 packages, $510; Chili, 119 packages, $2,187; Cuba, 17 cases, $550; Genoa, 24 packages, $2,063; Gijon, 5 packages, $226; Glasgow, 34 packages, $3,023; Hamburg, 57 packages, $5,533; Havre, 67 cases, $4,283; 7 cases auto parts, $295; Hayti, 3 cases, $59; Liverpool, 111 packages, $5,409; 5 packages cables, $2,657; 2 auto vehicles, $1,250; London, 464 packages, $37,267; 4 packages cable,

$1,111; Madrid, 1 case, $70; Manchester, 3 cases, $445; Mexico, 74 cases, $3,458; Naples, 7 cases, $309; New Castle, 2 cases, $100; Peru, 76 packages, $4,627; Santander, 5 cases, $508; Southampton, 3 cases, $124; 7 packages, $1,155; U. S. Colombia, 53 packages, $1,573; Walsall, 4 cases, $100.

The following are the exports of electrical material, from the port of New York, for the week ended July 19:

Antwerp, 13 cases, $986; 3 packages, $11,250; Argentine Republic, 160 packages, $8,998; Australia, 23 packages, $10,794; Barcelona, 2 cases, $250; Berlin, 7 packages, $188; Brazil, 60 packages, $5,597; Bristol, 1 package, $1,100; British Possessions in Africa, 90 packages, $7,477; British East Indies, 28 packages, $276; British West Indies, 173 packages, $2,588; Central America, 1 package, $119; Charente, 22 packages, $374; Cuba, 39 packages, $851; Genoa, 2 packages, $77; Glasgow, 9 packages, $338; Hamburg, 19 packages, $718; Havre, 21 packages, $2,687; 10 cases, $340; Liverpool, 114 packages, $9,068; London, 125 packages, $4,825; Mexico, 2 cases $468; 170 packages, $931; 2 cases telephone material, $102; Milan, 56 packages, $1,431; Newcastle, 5 packages, $1,100; Newfoundland, 12 packages, $223; Nova Scotia, 27 packages, $246; Peru, 21 cases, $575; Reval, 3 cases motors and parts, $2,478; Santo Domingo, 13 packages, $86; St. Petersburg, 8 packages, $651; U. S. Colombia, 21 packages, $752; Venezuela, 46 packages, $1,237.

Successful Operation of the Boston Elevated.

The Boston Elevated Railway Company, which has devoted much time and care to the proper equipment of the new elevated service, has had the road in operation a little more than a month with very gratifying results. The conditions existing there are most exacting and extremely severe upon the equipment. The Sprague Multiple Unit System, which was adopted after the most exhaustive tests, has proven to be entirely satisfactory.

A striking characteristic of this road is that at all stations, both on the elevated and in the subway, transfers are issued to surface lines. This makes the service unique, as nearly every station is practically a terminal and the number of passengers getting on and off the trains at each station is far in excess of that in any other elevated service.

The service has proven so popular that the one hundred cars it has in operation are found to be insufficient for its requirements, and the company has just awarded the Sprague Electric Company a contract for fifty additional multiple unit equipments.

COMING ELECTRICAL EVENTS

American Institute of Electrical Engineers—General Meeting, Buffalo, N. Y., August 20-24.

American Street Railway Association—Convention, New York City, October 9, 10 and 11.

Association of the Edison Illuminating Companies—Meeting, September 10.

International Association of Municipal Electricians—Convention, Niagara Falls, September 2, 3 and 4.

Ohio Electric Light Association—Convention, Put-in-Bay, August 20, 21 and 22.

Old-Time Telegraphers' Association and U. S. Military Telegraph Corps—Convention, Montreal, September 11, 12 and 13.

Pennsylvania State Street Railway Association—Convention, York, Pa., September 4.

Roentgen Society of the United States—Meeting, Buffalo, N. Y., September 10 and 11.

INCORPORATIONS.

The Electric Sparking & Illuminating Company, Limited, Battle Creek, Mich. Capital stock, $150,000.

The Electric Roller Milling Company, Chicago, Ill. Capital stock, $12,000. Incorporators: Peter Reyland, Joseph Lully and Margaret Lully.

The United Supply Company, East Orange, N. J.—to manufacture, buy and otherwise acquire and to sell and deal in railway and construction equipments and materials used in connection with electricity, or with any other like form of energy, or in connection with lighting, heating or chemistry. Capital stock, $20,000. Incorporators: Alfred George Brown, Edward B. Hawkins and Albert Robert Palmer.

The Monroe County Electric Belt Line Company, Rochester, N. Y.—to operate in Monroe County. Capital stock, $250,000. Directors: Percy R. McPhail, Ira M. Luddington, George W. Aldridge and Merton E. Lewis, Rochester; Andrew H. Bawn, Penfield; Walter A. Parce and D. C. Becker, Fairport; W. H. Rowerdink, Brighton, and Frederick W. Guernsey, Pittsford.

COMMERCIAL PARAGRAPHS.

At the present time Messrs. Sipe & Sigler of Cleveland, O., manufacturers of the Willard battery, have underway twelve large plants of Willard batteries, including street railway batteries, central station batteries, large isolated lighting plants and batteries in Government coast defense work. The latest contract is for a storage battery for the Cleveland Electric Railway Company, which will probably be the largest battery in street railroad service in the world. This battery will consist of 282 cells of 4,000 ampere hours' capacity and will weigh nearly five hundred tons when completed. The Cleveland Electric Railway Company, for whom this battery is to be installed, owns and controls more than two hundred miles of street railroad. It recently installed in one of its branches two Willard batteries, and to the satisfactory operation of the same is largely due the present large installation.

"The Thousand Islands."

The latest issue of the famous "Four-Track Series," the New York Central's book of travel and education, is No. 10, entitled "The Thousand Islands," a sixty-four page pamphlet, beautifully illustrated by half-tone reproductions, and giving, practically, all the information that could be desired by those contemplating a summer sojourn, or a trip to this wonderful health and pleasure resort, has just been issued by the Passenger Department of the New York Central.

This pamphlet gives a complete description of the various trips and points of interest throughout the numerous islands, together with illustrations of the various hotels, their situations, rates, etc., and will be found of great value and interest to those unacquainted with this region.

A copy of "The Thousand Islands" will be sent free, post-paid, on receipt of a two-cent stamp, by George H. Daniels, General Passenger Agent, Grand Central Station, New York.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 16, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

678,377. Motor Gear-Case for Electric Cars. William Cox, Toronto, Canada, assignor to John Maitland Smith and Alexander Maitland Smith, same place. Filed Dec. 5, 1900.

678,559. Current-Collector or Trolley for Electric Railways. William Grunow, Jr., Bridgeport, Conn., assignor to McElroy-Grunow Electric Railway System, same place. Filed April 22, 1901.

678,617. Guiding Device for Trolleys. Anthony J. Griffin, New York City. Filed Nov. 6, 1900.

678,761. Car-Fender. Lawrence P. Platt and Frank Warga, Hastings, Pa. Filed Oct. 18, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

678,386. Electric-Arc Lamp. William H. Fitzhugh, Bay City, Mich. Filed May 11, 1901.

678,446. Inclosed-Electric-Arc Lamp. Ernest P. Warner, Chicago, Ill,, assignor to the Western Electric Company, same place. Filed April 30, 1900.

678,482-678,483-678,560. Electric-Arc Lamp. Josef F. Hallberg, New York City, assignor to the General Incandescent Arc Light Company, same place. Filed Nov. 18, 1900.

678,492. Electric Switch. Charles A. Hussey, New York City, assignor to William P. Pincard, Birmingham, Ala. Filed Nov. 1, 1900.

678,517. Electric-Arc Lamp. William F. Ritter, Cincinnati, O. Filed March 21, 1901.

678,544. Electric-Light Wire Molding. Frank H. Corduan, Brooklyn, N. Y., assignor to John B. Peck, same place. Filed Dec. 29, 1899. Renewed June 6, 1901.

678,576. Electric-Arc Lamp, George M. Lane, Newark, N. J. Filed Nov. 14, 1900.

678,607. Electric-Arc Lamp. James J. Wood, Fort Wayne, Ind. Filed Dec. 14, 1900.

ELECTRICAL MACHINERY AND APPARATUS.

678,656. Rotor for Alternating-Current Generators. Ernst Danielson, Stockholm, Sweden. Filed Oct. 12, 1900.

678 664. Electric-Motor Controller. David J. Hauss, Cincinnati, O., assignor of one-half to John J. Cushing same place. Filed March 5, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

678,339. Calling Appliance for Telephone-Switchboards. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric Company, Chicago, Ill. Filed June 17, 1898.

678,509. Long-Distance Relay Magnetic Telephone. Jacques Nessel and Jean F. Gouin, Brest, France. Filed April 14, 1900.

678,566. Phonic Apparatus. Daniel Higham, Winthrop Highlands, Mass. Filed April 25, 1901.

678,632. Toll Apparatus for Telephones. Edward P. Baird, Evanston, Ill., assignor to the Baird Manufacturing Company, Chicago, Ill. Filed July 2, 1900.

678,633. Telephone Toll Apparatus. Edward P. Baird, Evanston, Ill., assignor to the Baird Manufacturing Company, Chicago, Ill. Filed Feb. 20, 1901.

MISCELLANEOUS.

678,363. Telegraph and Cable Code. Adolphus W. Greely, Washington, D. C. Filed Aug. 1, 1900.

678,394-678,395. Telegraphic Instrument. John J. Ghegan, Newark, N. J., assignor to J. H. Bunnell & Company of New York. Filed Feb. 26, 1900, April 16, 1900.

678,410. Electrically-Heated Tool. Harry W. Leonard, East Orange, N. J. Filed April 24, 1896.

678,426. Electric Clock. Emilio Rosi, Arquata-Scrivia, and Giuseppi Vacotti, Serravalle Scrivia, Italy. Filed Dec. 19, 1898.

678,436-678,512. Storage Battery. David P. Perry, Chicago, Ill. Filed May 7, 1900.

678,443. Storage Battery. William J. Still, Toronto, Canada. Filed March 24, 1899.

678,475. Electric Signaling System. Henry G. Carleton, New York City, assignor to the Carleton Electric Company, same place. Filed Sept. 29, 1900.

678,505. Telegraphic Transmitting, Receiving and Translating Arrangement. Alexander Muirhead, Shortlands, Eng. Filed Sept. 5, 1900.

678,518. Variable-Pressure Electric-Current Transformer. Conrad J. Ritzer, Schenectady, N. Y. Filed March 11, 1901.

678,520. Automobile. Louis C. Savale, Paterson, N. J. Filed May 29, 1901.

678,522. Electrically-Heated Cooking Utensil. Michael Seips, Meriden, Conn., assignor to Manning, Bowman & Company of Connecticut. Filed Dec. 8, 1900.

678,603. Magnetic Puzzle. John L. Woolf, New York City. Filed May 31, 1901.

678,622. Motor-Vehicle Driving Mechanism. Thomas B. Jeffery and Robert W. Thompson, Chicago, Ill., said Thompson assignor to said Jeffery. Filed Oct. 27, 1900.

678,677. Electric Sign. Thomas E. Murray, New York City. Filed April 19, 1901.

678,706. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Original application filed Dec. 12, 1899. Divided and this application filed June 3, 1901.

678,707. Art of Manufacturing Movable Coils for Use in Connection with Electrical Measuring Instruments. Edward Weston, Newark, N. J. Filed Nov. 27, 1899.

678,708. Apparatus for Constructing Movable Coils of Electrical Measuring Instruments. Edward Weston, Newark, N, J. Filed Dec. 18, 1899.

678,722. Reversible Galvanic Battery. Thomas A. Edison, Llewellyn Park, N. J. Original application filed March 1, 1901. Divided and this application filed June 20, 1901.

678,746. Method of Telegraphing, Indicating Time or Actuating Mechanism Electrically. Cesar R. Loubery, Paris, France. Filed July 9, 1900.

678,782. Electrode for Water-Heaters. Harry M. Hill, St. Louis, Mo. Filed Oct. 25, 1900.

678,803. Device for the Production of Continuous Current in Regular Pulsations. Edmund van Haanen, Vienna, Austria-Hungary. Filed Jan. 19, 1901.

DESIGN.

34,800. Casing for Electrical Meters. Edward W. Jewell, Chicago, Ill. Filed May 24, 1899. Term of patent 1 years.

THE TELEPHONE WORLD.

Independent Telephone Association of Southern Indiana.

The second annual convention of the Independent Telephone Association of Southern Indiana will be held in New Albany on Thursday and Friday, August 1 and 2. There has been an extensive programme prepared for the two days' meeting and a large number of delegates is expected.

The objects of the Association are: The protection of all independent telephone interests of the Association; to bring about reasonable rental charges and tolls so that the telephone may be within the reach of the masses.

Any one engaged in the manufacture of telephones or switchboards or any corporation or copartnership or individual engaged in the operation of an independent telephone may become members of the Association.

The meeting will likely be well attended and much good result.

Those from the Home Telephone Company of New Albany, who are on the programme to read papers, are Messrs. Chas. D. Knoefel, George Borgerding and Superintendent Frank Beaucond. Mr. Coleman, of Louisville, who is constructing the independent system in that city, is also on the programme for a paper.

Maine's Tax on Telephones.

The State assessors have computed the tax on telephone companies for 1901. The total amount is $14,201.02, against $11,020 46 for 1900. Last year the companies were taxed on valuation of equipment, etc. By an act passed by the last Legislature the tax is determined on gross receipts of business done in the State at the rate of 1¼ per cent. on $1,000 and less than $5.000. Over $5.000 the rate is increased in proportion. The New England Telephone & Telegraph rate is 4 per cent.

At a recent special meeting of the board of county commissioners held at Atlanta, Ga., the application of the Clipper Manufacturing Company for the right to construct a rural telephone system was considered. The application of the company asked the right to extend a line along some of the public thoroughfares to the country towns of the county. The new line will connect with the Standard line in Atlanta. The company will go to East Point, Hapeville, Manchester. Jonesboro and Lithonia. After considering the application of the company, the board, which was favorable to granting the franchise, decided to refer the matter to the committee on roads and bridges, with power to act. The committee was instructed to place upon the grant certain limitations, which the board regards as necessary.

At a meeting of the board of directors of the Baraboo, Wis., Telephone Company, it was decided to run two additional wires between Baraboo and Ableman, and one additional wire between Ableman and Reedsburg. This will give four wires to Ableman and two to Reedsburg, making a metallic circuit from Baraboo, by way of North Freeland and Ableman, to Reedsburg.

Philadelphia and Trenton capitalists composing the Interstate Telephone Company have purchased controlling interests in the Paterson, Passaic & Suburban Telephone Company. The Interstate Company controls the southern part of the State of New Jersey. For some time past it has been trying to reach New York. but at Jersey City, Newark and other towns was blocked by the Bell Company. Now that it owns the Paterson, Passaic & Suburban Company it has franchise rights as far as Rutherford.

The annual meeting of the Dirigo Telephone Company of Maine was held recently at Portland, when Lewis A. Goudy was elected president and general manager. It was voted to increase the capital to $250,000, of which $100,000 is a preferred first lien 6 per cent. stock, and $150,000 common stock. The company also authorized the issuance of 6 per cent. bonds for the expansion of its service.

The ordinance granting a franchise to the B. F. Pankey Telephone Company, to put in an independent telephone line to Topeka, Kan., was lately passed without opposition. The company will give to the city, free of charge, 20 long-distance 'phones. These 'phones will be placed in the city offices, the fire stations, and anywhere else the city may direct.

A report from Sparta, Tenn., says a franchise has been granted the Overton Telephone Company and it expects to run wire soon. The Gainesboro Company was allowed one side of the street and the Overton Company the other. Upon the entrance of the new company a lively telephone war is expected.

A telephone line will be built from Woonsocket to Mitchell, S. D.

Telephone Consolidation.

A consolidation of long-distance and local telephone systems of Southwestern Missouri and Northwestern Arkansas on the "community of interest" plan was effected at Eureka Springs a short time ago. J. W. Hill, who owns the Eureka Springs system, a line to Seligman, Mo., recently acquired the Barry Company's Missouri system, which connects with Seligman and reaches Cassville, Exeter, Purdy, Butterfield, Washburn and Monet.

From Monet there is another system reaching Pierce City, Mt. Vernon and Sarcoxie, owned by the president of the Illinois Steel Company and Chicago capitalists. George Armstrong, manager for this company, then bought the Barry Company's system of Mr. Hill, and he and Mr. Hill consummated a deal by which the Ozark system east of Eureka Springs and the line from Seligman to Fort Smith also comes in. The entire system will be equipped with a metallic circuit, establishing direct communication between Yellville, Harrison, Eureka Springs, Springfield, Fort Smith and all other points before mentioned.

Coal Mine Companies Advise Using Telephones in Mines.

Among the big mine companies there is talk of putting telephones in the coal mines. In the days of doubt which followed the disaster at the Twin Shaft, near Pittston, Pa., a few years ago, when 60 lives were lost by the extensive caving in of the mine, the telephone might have been used to advantage in letting the rescuers know the exact location and condition of the imprisoned miners. Of course it is possible that such a subterranean disaster might render the telephone useless in the mine, but engineers are of the opinion that with reasonable ingenuity and care it is possible to introduce and operate a mine telephone that would not be affected by the caving in of the surface.

Such an improvement would be a great boon to the mine workers, and its general introduction is regarded as a proximate possibility. Having some means of communication with those who are entombed in the depths of the mine would greatly assist in the work of their rescue. It has often happened in the history of mine accidents that the efforts of rescuers were put forward in a direction entirely different from that in which the men were imprisoned, and thus valuable time and energy were wasted. With a system of mine telephoning in operation this would be averted. The plan suggested by those who are friendly to the proposed improvement is to locate telephones at regular intervals along the workings, so that they may be protected as well as possible from accident, and be of easy access to the miners in case of danger. An experienced miner said recently that he thought it entirely feasible to have a telephone in every mine "chamber," and carry it forward as the work progressed. Also that telephones might be placed at regular intervals along the gangways, and electric lights, too.

"I would not have the wires running along the roofs, in the first place," he said. "I would run them carefully down the shaft or slope and along the floor of the mine, close at the side, where they would encounter the least resistance. I am positive they could be introduced in that way and made serviceable. Fancy what a benefit the telephone would have been at the Twin Shaft! It is generally believed that the men who were caught in that accident, lived for several days, but it was impossible to locate them. They went in to do repairs, and nobody knew what part of the mine they were in when the cave in occurred. Then, again, I believe the telephone could have rendered great service at Avondale and at Carbondale, Pa., in the fearful disasters which cost so many lives at those places, but it was not discovered in those days."

The Michigan Telephone Company announces in Houghton that the company will build a line connecting Houghton County with the Ontonagon County mines, and will purchase the Standard Brothers' system in that county if guaranteed $5,000 in long distance tolls. As communication is greatly needed the mining companies, banks, etc, are taking the proposition up and it will doubtless go through.

At the annual stockholders' meeting of the Standard Telephone & Electric Company at Madison, Wis, the following officers were elected: President, Thomas H. Gill; vice president, A. L. Hutchison; secretary and treasurer, E. W. Batchelder, of Madison. The company's capital stock was reduced to $300,000.

This month the Winfield, Ia., Independent Telephone Company declared its first semi-annual dividend. It was 16 2-10 per cent.

A recent fire in the business portion of Marshall, Mo., caused a loss of about $5,000 to the Saline County Telephone Company. The property was well insured.

Maryland's Telephone Competition.

The war between the Bell and the Maryland Telephone Companies, in Maryland, is forcing both companies to cut rates to the lowest point and to extend lines in every direction. The Union Telephone & Telegraph Company, which owns the Maryland Telephone Company, has been quietly extending its lines into Baltimore and Harford Counties and into Pennsylvania. By acquiring existing lines, building new ones, or securing contracts with other companies, it has brought into direct communication with Baltimore a large area.

The company has bought the Creswell Company, the Baltimore and Harford County Company, and effected a long term contract with the Highland Company, which enables it to cover every point of the northern counties to and beyond the Pennsylvania line. A branch from Darlington, in Harford County, crosses the Susquehanna River into Cecil County at Conowingo, and continues to Delaware. Franchises have been secured for a long distance line between Baltimore and Wilmington, Del. The Maryland Company is vigorously pushing the Bell in every part of the State. There will be two lines across the Susquehanna River, one at Havre de Grace.

The Illinois Telephone & Telegraph Co., of Chicago, has $5,000.000 with which it will continue the construction of its plant at once. President Wheeler has been in New York, completing arrangements for the bond issue, and it is expected that on his return the details of the company's purposes will be made public. The Strowger Automatic Telephone Company, which manufactures the instrument to be used by the Illinois Company, has closed a contract with the German postoffice department for the exclusive use of its telephones throughout the empire. The Strowger Company has a factory in Chicago, where most of the instruments for Germany will be manufactured.

The Long Distance Telephone Company of Virginia held its annual meeting at Staunton, when the officers and directors for the next year were chosen. The following officers were elected; J. R Kemper, president; C. W. Scott, vice-president. Simon R. Curtis, of Warwick County, was put on the board of directors in place of F. W. Sims, of Louisa County. The board then held a meeting and elected Mr. George A. Gulley secretary. The company will increase its stock to $100,000, and will build lines to connect with Richmond and Baltimore.

Gov. Stone, of Pennsylvania, has signed a bill which makes it a misdemeanor for an employe of a telephone or telegraph company to impart to a third person any information he may acquire because of his position during the transmission of messages. The new law imposes a penalty of $100 fine imprisonment for six months, or both.

The Low Gap Telephone Company has decided to put in a local exchange at Ludlow, Mo., if enough 'phones can be secured to justify the movement.

A new telephone line has been built from Nebraska City to Cook, Neb.

The work of putting the New England Telephone wires underground has begun at Burlington, Vt.

Telephone Companies Increase Stock.

The Youngblood Stamper Telephone Company, Benton, Ill., from $12,000 to $15,000. The Sikeston Telephone Company, Sikeston, Mo., from $12,000 to $20,000.

TELEPHONE INCORPORATIONS.

The Mexican National Telephone Company of Mexico—to operate in Mexico. Capital stock, $1,000,000.

The Boynton Telephone Company, Pleasant Plains, Ill. Capital stock, $2,500. Incorporators: E. D. Boynton, J. M. Howard and O. E. Ferry.

The Magnolia Mutual Telephone Company, Magnolia, Ill. Capital stock, $2,500. Incorporators: Perry Dakin, E. E. Barbour and John Davidson.

The San Angelo Telephone Company, San Angelo, Tex Capital stock, $80,000. Incorporators: J. Y. Pust, J. W. Sims and L. Pust.

The Meredith Telephone Company, Meredith, N. H. Capital stock, $2,500. Officers: President, B. Blaisdell; vice-presidents, J. F. Beede, George H. Clark, F. W. Towle and B. R. Dearborn.

The Concordia Telephone & Telegraph Company, Concordia, Kan. Capital stock, $20,000. Directors: George G. Hill, Washington; William Lute and F. W. Daugherty, Concordia.

GENERAL ELECTRICAL NEWS.

Lighting.

Bear Creek, Wis.—This village will have an electric light plant by next fall. Work will commence soon. The cost of the plant will be $2,000.

Ellicott City, Md.—At a special meeting of the Ellicott City council an arrangement was effected with the Patapsco Electric & Manufacturing Company for furnishing the town with electric lights for three years.

Ellisville, Miss.—The Newman-Spranley Company of New Orleans are the contractors at $12,850 for the erection of the electric plant here.

Gloster, Miss.—J. Z. George and A. Q. Pearce of Vicksburg, Miss., may get the contract for the construction of the electric plant and waterworks in this place.

Grand Island, Neb.—The Grand Island Gas Company expects to have its electric light plant in operation after August 1.

Grantsburg, Wis.—The Grantsburg Electric Light & Power Company has made application for a seventy-year franchise to build and operate a plant to furnish light and power to this village.

Greensboro, N. C. The Greensboro Electric Light & Power Company will install a complete plant for incandescent lights, power, etc. Work has been commenced on the buildings. R. J. Marks is manager.

Greenville, N. C.—Plans and specifications of J. L. Ludlow, of Winston, for the city's proposed waterworks, electric lights and sewerage have been accepted.

High Springs, Fla.—Capt. W. E. Bell, J. B. Butler and others are interested in the establishment of an ice and electric light plant here.

Humboldt, Tenn.—The citizens have voted the issuance of $30,000 of bonds for the erection of an electric plant and waterworks. Address the mayor.

Jersey City, N. J.—Plans have been drawn and specifications prepared for a $150,000 power house and plant to be erected in Kearny on a site yet to be decided upon by the New Jersey Light & Power Company, with the intention of competing with the United Electric Company.

Kissimmee, Fla.—This town has purchased W. C. Maynard's electric light plant, and will enlarge the same. Address the mayor.

Lakewood, N. J.—The Tuckerton Electric Company, recently incorporated, proposes to run the lighting plant by water power at the dam: and also to give the borough 140 sixteen cp. incandescent lights for $750 per year.

Laurel, Md.—This city will purchase and operate the electric light plant of the Laurel Electric Light Company. Address the mayor.

Oakland, Me.—Oakland is figuring for an electric light service.

Ottumwa, Ia.—The recent special election resulted in granting an extension of 25 years of the franchises of the Ottumwa Electrical Company, including street car, electric light and steam franchises.

Port Deposit, Md.—A meeting of persons interested in the reorganization of the Port Deposit Electric Light Company was held a short time ago. The plant is to be improved with increased lighting facilities. R. E. McClenahan was elected president; W. W. Hopkins, vice-president; John McClenahan, secretary, and D. George Wilson, treasurer and superintendent.

Scottsburg, Ky.—The people of this place are maturing plans for an electric light and waterworks system, which will be consolidated. It is estimated the plant will cost $30,000.

Tullahoma, Tenn.—This city will, it is reported, soon ask for new bids on the construction of a $35,000 electric light plant and waterworks. Address the mayor.

Union, Ia.—There is talk of an electric light plant at this place.

Will's Point, Tex.—The citizens have voted to erect a school building to replace the one destroyed by the cyclone, and a system of waterworks, electric light plant and ice factory will be put in soon.

Webster, S. D.—The city council will soon issue a call for a special election for the purpose of voting upon the question of issuing bonds for a waterworks system and electric light plant.

Woodstock, Va.—The contract for putting in an electric light system for this place was recently awarded to the American Electric Company of Baltimore.

Street Railways.

Aiken, S. C.—An ordinance was lately passed admitting the Augusta-Aiken Electric Railway into this city, and granting free franchise to certain streets therein named.

Atlanta, Ga.—A franchise has been granted giving the Atlanta Rapid Transit Company right-of-way along several additional streets.

Bunker Hill, Ill.—A new electric line is being surveyed through Bunker Hill, which is to connect Springfield and Edwardsville.

Byesville, O.—The commissioners of Gurnsey County have granted a franchise to Messrs. John S. Black and Lakin Taylor to build an electric railway line through the county.

Ft. Wayne, Ind.—The Ft. Wayne & Southwestern traction lines have been purchased by a syndicate headed by the Governor of Maine and $3,000,000 will be spent in building new lines in Indiana.

Grafton, W. Va.—E. M. Wilkins of this place has applied for a franchise to build an electric railroad in the city and suburbs.

Hartford, Ky.—It is stated that a company is now being formed to build the proposed electric railroad from this place to Beaver Dam, a distance of five miles. S. A. Anderson of Hartford can be addressed.

Janesville, Wis.—H. H. Clough, of Elyria, O., of the new electric interurban line between Rockford, Ill., and this city, is endeavoring to build the line to Delavan Lake at once.

Madison, Wis.—P. L. Spooner of this city has filed an application with the city council of Stoughton for a franchise to construct and operate an electric railway in that city, and the matter is to be taken up at once.

Maryville, Mo.—Dr. V. S. Campbell has secured a franchise from the Nodaway County Court for an electric railway to be built on the public highway between Maryville, Graham, Skidmore and Quitman. The proposed route is 50 miles long.

Mount Pleasant, N. Y.—The Schenectady Railway Company has made application for a franchise to construct an electric road from here to Athens Junction.

New York City.—To-morrow there will be a public hearing in the city council chamber on the application made by the Union Railway Company, known as the Huckleberry Road, to build a double-track surface railway over Macomb's Dam Bridge and the viaduct at 155th street, connecting various lines operated by the Union Railway Company in the Bronx with street railway lines in Manhattan. These proposed extensions are indorsed by many residents in the Bronx.

Oshkosh, Wis.—The Wisconsin Interlake Electric Railway Company has been organized to connect the lakes of Southern Wisconsin with an electric railway.

Richmond, Ind.—A new electric line project is being agitated here.

Richmond, Va.—It is stated that work is about to begin upon the electric railroad between here and West Hampton Park, in the suburbs. L. M. Williams, of this city, is president of the company.

San Bernardino, Cal.—The San Bernardino County Traction Company has been incorporated; it is composed of citizens of Redlands, and will build a trolley line connecting Redlands, San Bernardino and Colton.

Sharon, Pa.—The stockholders of the Sharon-New Castle Street Railway held a meeting last week and authorized the issue of $500,000 bonds, for the construction of a trolley line from this city to New Castle, 21 miles in extent. M. A. Devitt, of Chicago; H. W. Whipple and George F. Penhale, of New York, are the promoters.

Stevens' Point, Wis.—At a recent meeting of the common council a franchise was granted the Wisconsin Valley Lighting & Power Company to construct and operate an electric railway through the city. This company proposes building a line between here and Grand Rapids, and promises to commence work early in September.

Warren. O.—The Trumbull Electric Railroad Company of this city has amended its charter enlarging its purposes. William Wallace is president and John E. McVey secretary.

Westport, N. Y.—It is rumored in the Adirondacks that an electric road is to be built from this place, on Lake Champlain, to Elizabethtown. A route has been surveyed and found feasible, and it is said that the members of the board of supervisors of Essex County have assured the promoters that permission for the line and the right-of-way will be given if wanted. It is understood that the capital with which to construct such a road is ready, and that the promoters express confidence in the successful outcome of the enterprise.

Yorktown, Va.—An electric railroad is to be built from here to Hampton.

Manufacturing.

Cincinnati, O.—The Bullock Electric Manufacturing Company of this city has decided to erect a plant in England for the purpose of manufacturing its specialties for the British market.

Montreal, Can.—Application is to be made for a charter of incorporation by letters patent for the Ampere Electric Manufacturing Company of Montreal, with a proposed capital stock of $50,000.

Rochester, N. Y.—The Rochester Electrical Manufacturing Company is said to be meeting with success in the introduction of the Miller cut-out, a device to prevent the police telegraph and fire alarm boxes from being burned out when the wires of the system become crossed with trolley or electric light wires.

Company Matters.

Pittsfield, Mass.—The stockholders of the Stanley Electric Manufacturing Company have received letters stating that the capital stock of the company has been increased from $1,250,000 to $2,000,000.

Watertown, N. Y.—The stockholders of the Black River Traction Company lately elected the following directors: J. A. Lebkuecher, George Kremintz, Chandler W. Rider and Paul Sala, of Newark, N. J.; N. P. Wardwell, H. F. Inglehart, George H. Walker and Thomas Burns of this city. The directors elected the following officers: President, J. A. Lebkuecher; vice-president, George Kremintz; treasurer, N. P. Wardwell; secretary, George H. Walker.

Power and Transmission.

Albany, N. Y.—According to the report of the Kings County Almshouse, filed with the State Board of Charities, a saving of $19,000 would result from the installation there of a private electric power plant.

Belfort, N. Y.—The Carthage Electric Light & Power Company is rushing the work of developing its power plant at this place. The company is capitalized for $75,000. Its officers are J. E. Strickland, president; C. M. Rohr, vice-president, and P. J. Corcoran, general manager.

Automobiles.

New York City.—Announcement was made last week that a committee would soon be named to effect the reorganization of the General Carriage Company. The concern was incorporated under the laws of New Jersey on May 2, 1899. It controls a corporation in this city of the same name whose charter gives it the right to operate public vehicles in any city in the State. The company is establishing and operating a cab and local express service in this and other cities with automobiles, it having the right to use electricity, compressed air or any other power. Its capital stock consists of $20,000,000. Joseph Leiter is one of its most active directors.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Albany, N Y.—July 22						
United Traction (Consolidation of the Albany and Troy City Railway.)	100	$5,000,000	$5,000,000	1½ % Q.,	105	107
Allentown Pa.—July 22						
Allentown & Lehigh Val. Trac. Co	..	4,000,000	1,500,000	....	--	15
Bridgeport, Conn—July 22:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug.,	100	...
Baltimore Md—July 22						
a United Rail ways & Elec. Co...com	50	24,000,000	18,000,000	....	16⅛	16⅝
Boston, Mass.—July 22						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan. 15,	...	--
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	15	16
North Shore Traction Co........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	85	87
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	3½ % S., Oct.,	95	95¼
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Jan.	110	110⅛
Boston Elevated R. R	100	10,000,000		2¼ % Aug. 99,	179	181
Brooklyn N. Y.—July 22:						
Brooklyn City Ry	100	2,000,000	1,928,400	....	241	245
Brooklyn Rap. Transit Co., tr certf..	100	48,000,000	48,000,000	....	75½	75¾
cBrooklyn Heights Railroad	....	200,000	200,000	....	107	109
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	3½ % Q., Jan.,	237	239
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	2,000,000	1,884,200	2½ % Nov.,	325	330
Kings County Elevated	....	4,750,000	4,750,000	....	--	...
Kings County Traction Co	100	4,500,000	4,500,000	1 % July	..	..
Nassau Electric Railroad.......pfd.	......	6,000,000	6,000,000	....	82	83
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	--	--
gBrooklyn, B. & W. E. Railroad..	....	1,000,000	1,000,000	....	--	--
Buffalo N. Y.—July 22:						
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	....	74	75
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec.	99	100
Columbus O.—July 22						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb.	38	39
Columbus Street Railroad, pfd....	100	1,500,000	1,500,000	....	100	102
Charleston, S. C.—July 22						
Charleston City Ry. Co	50	100,000	100,000	3 % S.	--	--
Enterprise City RR. Co	25	1,000,000	250,000	....	--	--
Chicago, Ill.—July 22						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31,	250	260
Chicago & South Side R. T. RR	100	10,823,800	10,823,800	....	--	--
Lake Street Elevated RR	100	10,000,000	10,000,000	....	13¾	14
Metropolitan West Side Elev. Ry...	100	15,000,000	7,000,000	Feb 28 1900.	34½	35
Met. West Side El., pfd	100	15,000,000	9,000,000	....	89	90
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan.	209	210
hNorth Chicago City RR	100	500,000	249,900	....	200	201
South Chicago City Railway	100	2,000,000	1,608,200	....	108	109
West Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Feb.	100	101
Union Traction Ry..........com	....	1,250,000	624,900	35 %	17½	17¾
Union Traction Co. ....pref.	100	2,000,000	2,000,000	5 % S.	57	59
Cincinnati, Ohio.—July 22:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	--	--
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	½ % Feb.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	3,000,000	3,500,000	2½ % Feb.	75	76
iCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan.	124½	125
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan.	126½	127
Cleveland, Ohio—July 22:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan.	48	50
Cleveland City Ry	100	8,000,000	7,600,000	8-5 % Jan.	100	102
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct.,	80	81
Detroit, Mich.—July 22:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	....	1,200,000	....	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—July 22						
City Railway Co..........com	100	1,500,000	1,470,600	1¼ % Q.	140	145
City Railway Co..........pf	100	600,000	600,000	1½ % Q.	170	..
People's Street Railway		1,100,000	1,100,000	....	114	115

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Hartford Conn—July 22						
Hartford Street Ry. Co	100	$4,000,000	$300,000	3 % S., Oct.,	150	-
Hartford & West Hartford	100	1,000,000	247,000	....	--	-
Holyoke Mass.—July 22						
Holyoke Street Ry. Co	100	400,000	400,000	3 % A., June,	207½	212
Hoboken N. J.—July 22						
North Hudson Co. (N. J.) Ry. Co..	25	1,250,000	1,000,000	8 %,	180	-
Indianapolis, Ind—July 22						
**Indianapolis Street Ry	....	5,000,000	5,000,000	....	25	25½
Lancaster, Pa.—July 22						
Pennsylvania Traction Co	100	10,000,000	9,901,000	....	--	-
Lancaster & Col. Electric Ry	....	....	37,500	....	--	-
West End Street Railway	....	....	....	....	--	-
Louisville, Ky.—July 22:						
Louisville Ry..........com	100	4,000,000	3,500,000	1¼ %., April.	82	83
Louisville Ry..........pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1,	112	113
Minneapolis, Minn.—July 22						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	89	89¼
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,712,200	1¾ %. Oct.	186	187
Montreal, Canada.—July 22						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	279	280
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1¾ % S., J. & J.	108¾	109½
Memphis Tenn.—July 22						
Memphis Street Railway Co	100	500,000	500,000	....	25	-
New Haven, Conn.—July 22:						
Fair Haven & Westville RR	25	2,000,000	2,000,000	3 % S., Sept.	39	41
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July	...	...
New Haven & Centerville	100	700,000	800,000	....	..	-
Winchester Avenue RR	25	1,000,000	600,000	....	45	46
New Orleans, La.—July 22						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., July,	..	..
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Oct.	148½	152
New Orleans Traction Co new com.	100	....	....	....	26	28
New Orleans Traction Co new pfd.	100	....	....	....	102	103
aCrescent City RR.........guar.	100	2,000,000	2,000,000	3 % S., Jan.,	20½	26
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan.,	..	--
Orleans Railroad	50	500,000	185,000	1½ %., June,	..	52
St. Charles Street Railway	50	1,000,000	1,000,000	1¼ %. Oct.,	56½	57
New York—July 22.						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	260
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Oct.,	175	185
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Nov.	120	125
dMetropolitan Street Ry. Co	100	45,000,000	45,000,000	2½ % Q., Feb., 1901.	166½	166¾
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July,	36	37
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	244	249
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	205	210
hEighth Avenue RR	100	1,000,000	1,000,000	....	400	410
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	392	402
jNinth Avenue RR..........guar.	100	800,000	800,000	....	198	200
kSixth Avenue RR..........guar	100	2,000,000	2,000,000	....	208	210
lTwenty-third St. R. R. Co..guar.	100	600,000	6 ,000	4½ % Q.	400	410
Second Avenue RR	100	2,500,000	1,8 ,000	2 % Q., Jan.,	210	212
Third Avenue RR	100	12,000,000	10,0 000	$1.75 p. sh. Feb.	121	121¼
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,50 000	....	65	75
*Union (Huckleberry) Ry	100	2,000,000	2,00 000	....	190	200
Newark N. J.—July 22						
Consolidated Traction Co of N. J...	100	15,000,000	5,000,000	....	67½	68
North Jersey Railway Co.	100	6,000,000	,000,000	....	24	25
United Elec. Co. of New Jersey..	100	504,000	504,000	11¾ % A.	283½	284
Pittsburg, Pa.—July 22						
Allegheny Traction Co	50	500,000		....	27	28
oConsolidated Traction Co....com.	50	15,000,000		2 %, Jan.	20¼	21
Consolidated Traction Co......pfd.	50	9,478,850		3 %, Nov.	59	60
pCentral Traction Co	50	1,500,000		1½ % Nov.	73½	73¾
qCitizens' Traction Co	50	3,000,000		6 % A.	72½	72¾
rDuquesne Traction Co	50	3,000,000		6 % A.	..	...
sPittsburg Traction Co	50	2,500,000		3½ %, Nov.	..½	--
Federal St. & Pleasant Valley Ry..	25	1,400,000		2½ %, July,	27	29
Pgh., Allegheny & Man. Trac. Co....	50	3,000,000		2 %, Aug.	..	..
Pittsburg & Birmingham Trac. Ry..	25	1,500,000		1 %, Oct.	41	42½
Pittsburg & West End Ry	50	3,000,000		5 % A., June	..	..
United Traction Co..........com	50	17,000,000		J. & J.	13¼	18½
United Traction Co..........pre	50	3,000,000		J. & J.	51¼	

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*Unlisted. ‡ Ex div.

a The United Railways & Electric Company comprises in its organization the Baltimore Consolidated Railway Company, the Baltimore City Passenger Railway Company, all the lines of street railway operated by these companies, and also the Central Railway Co of Baltimore. The pref stock of U R & Elec Co has been issued in the form of income bonds.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250 100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranted by West Chicago Street Railway Company, lessee.

l Cincinnati St. Railway purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‖ Outstanding. ‡ Ex-div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Ry. at 8 % on stock until Oct. 1, 1897; thereafter 9 %.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1893, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter.

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 % on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens' Duquesne, Fort Pitt & Pitt'h Traction.

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock.

s Leased to Consolidated Traction Company for 7 % on capital stock.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authors'd	Issued.			
New Bedford Mass.—July 22						
Union Street Railway Co.	100	$850,000	$850,000	2 %, Feb.	160	165
Northampton, Mass—July 22						
Northampton Street Ry	100	300,000	225,000	4 % A., June.	170	173
Omaha, Neb.—July 22						
Omaha Street Ry	100	5,000,000	5,000,000	3 % A. and N.	55	65
Paterson N. J.—July 22						
Paterson Ry. Co.	100	1,250,000	1,250,000	....	54	--
Providence, R. I.—July 22						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Oct.	109	110
Philadelphia.—July 22						
Fairmount Park Trans. Co...$50 pd.	50	2,000,000	1,770,000	2 %, Dec.	28	24
Hestonville, Man. & Fairmount....	50	1,966,100	‖1,966,100	2½ %, July 15,	47	48
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	583,900	‡583,900	3 % S—July,	75	76
*a*Fairmount Pk. & Had. Pass. Ry.	50	300,000	300,000	3 % Feb. 1,	26½	27
Union Traction Co..........$12½ pd	50	30,000 000	29,980,450	....	30	30⅛
*c*Electric Traction Co.	50	....	8,297,920	....	..	...
*d*Citizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	445	..
*e*Frankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.	450	451
*f*Lehigh Avenue Ry. Co	50	1,000,000	....	....	48	...
*f*Lombard & South Street Ry...	25	....	1,000,000	A. & O.	90	90½
*d*Second & Third Streets Ry....	50	1,060,000	†771,076	$9 share A, Mar.	300	...
*c*People's Traction Co	50	10,000,000	†6,000,000	3 %, A., April,	...	..
*g*Germantown Passenger Ry....	50	1,500,000	‖572,800	$5.25 share—	150	151
*g*Green & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan.,	151	152
*h*People's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
*h*People's Passenger Ry....pfd.	....	750,000	‖277,402	....	...	...
*i*Philadelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh. Oct.	95	95¼
*j*Catherine & Bainbridge St.....	50	....	‖400,000	6 % A—Mar.,	...	..
*j*Continental Pass. Ry.....guar..	50	1,000,000	‖580,000	$6 share—July	158	157
Empire Passenger Ry. Co.....	50	600,000	‖600,000	....	...	..
*j*Philadelphia City Pass. Ry.....	50	1,000,000	‖475,000	$7.50 share July	208	208¼
*j*Philadelphia & Gray's Fy. RR..	50	1,000,000	298,650	$3.50 share July	100	..
*j*Ridge Avenue Passenger Ry....	50	750,000	‖420,000	$12 share, July	308¾	309
*j*Philadelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July,	...	..
*j*17th & 19th Sts. Pass. Ry. guar...	50	....	‖250,000	1½ % S., July,	..	..
*j*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖385,000	$11 sh. A., July,	300	..
*j*Union Passenger Ry. Co.......	50	1,500,000	‖900,000	$9.50 shre, July	239	240
*j*West Philadelphia Pass. Ry....	50	750.000	‖750,000	$10 share, July	262	263
Rochester, N. Y.—July 22						
Rochester Railway Co	100	5,000,000	5,000,000	....	25	28
Reading, Pa.—Junly 22						
*j*Reading Traction Co	..	1,000,000	1,000,000	Semi-an.,Jan. & Jy	24	26
*k*City Passenger Ry	50	350,000	350,000	Jan.,	138	...
*l*East Reading Electric Ry	50	1,000,000	‡1,000,000	Jan.,	70	--
St. Louis Mo.—July 22						
Fourth Street & Arsenal Ry	50	300,000	150,000	....	--	--
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec.	--	--
Lindell Ry	100	2,500,000	2,400,000	1¼ % Jan.	--	--
National Railway Co	..	2,500,000	2,479,000	1½ % Jan.	--	--
Cass Avenue & Fair Grounds....	..	2,500,000	2,500,000	....	--	--
Citizens' RR.	100	2,000,000	1,500,000	4 %, Oct.,	--	--
St. Louis RR.	100	2,000,000	2,000,000	2½ %, Jan.,	...	--
Missouri RR.	50	2,400,000	2,300,000	1½ % Jan.,	--	--
People's RR. Co	50	1,000,000	800,000	50c., Dec.,	..	...
United Electric Ry..........com.	50	500,000	500,000	....	24	25
United Electric Ry....... 5 % pref.	100	1,000,000	1,000,000	3 %, Jan.,	78¼	79
St. Louis & Suburban Ry	100	3,000,000	2,500,000	....	90	93
Union Depot RR.	100	4,000,000	4,000,000	3 % A., July,	--	--
San Francisco, Cal.—July						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	117	119
Geary Street Park & Ocean RR	100	1,000,000	375,000	$2.50 share,	50	..
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	61½	63⅜
Presidio & Ferries RR	100	1,000,000	550,000	....	--	16
Scranton Pa—July 22						
Scranton Railway Co	50	6,000,000	2,500,000	....	29	30
m Scranton & Carbondale Trac. Co.	100	500,000	500,000	....	16½	...
m Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	....	--	--
Springfield Ill.—July 22						
Springfield Consolidated Ry	100	750,000	750,000	....	--	--
Springfield O.—July 22						
Springfield Street Ry	100	1,000,000	1,000,000	....	--	11
Springfield, Mass.—July 22						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	207	212
Toronto Canada.—July 22						
Toronto Street Ry	100	6,000,000	6,000,000	1¾ % S.	109¼	110⅛
Montreal Street Railway Co	.....	4,000,000	4,000,000	4 % S.	279	280
Washington, D. C.—July 22						
Belt Ry. Co	50	500,000	500,000	....	--	--
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct.	103⅝	103⅞
Columbia Ry. Co	50	400,000	400,000	6 % A.	--	...
Eckington & Soldiers' Home Ry....	50	707,000	652,000	....	35	40
Georgetown & Tenallytown Ry.....	50	200,000	200,000	....	20	21
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	--	--
Worcester, Mass.—July 22						
*Worcester Traction Co........com.	100	3,000,000	3,000,000	....	32¼	35
Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb.,	107	108
Worcester & Suburban Street Ry ..	100	550,000	542,500	4½ %,	...	85
Wilkesbarre, Pa.—July 22						
Wilkesbarr & Wyoming Val Trac...	100	5,000,000	5,000,000	1 %, Jan.,	25	26

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex-div.

a Leased to Hestonville, Man & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Company at a rental of $10,000 per annum in 1866-7-8, p. a. $20,000 in 1899-1900 and $30 000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6 % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Co., formerly Scranton Traction Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authors'd	Issued.			
Boston, Mass.—July 22						
American Tel & Tel Co	100	50,000,000	28,650,000	4½ % Q., Jan.	159½	160
Erie Telegraph & Telephone Co....	100	......	......	1 % Q., Feb. 20,	48	48½
New England Telephone Co	..	10,894,600	10,804,600	$1.50 p. sh. Feb	141	141
New York.—July 22						
American Telegraph & Cable Co...	100	14,000,000	14,000,000	1¼ % Q	91	94
*Central & South Am. Teleg. Co.....	100	6,500,000	6,500,000	1½ % Q.	100	105
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	173	175
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	42	50
Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1 % Q., Feb.,	..	..
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	108	109
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	116	118
Mexican Telephone Co	100	2,000,000	......		2	2½
*New York & New Jersey Tel. Co..	100	5,000,000	3,723,000	2½ % Q., Jan.,	168	173
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	70	75
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	95	100
†Commercial Union Telegraph Co...	25	500,000	500,000	3 % S., Jan.,	115	..
Western Union Telegraph Co.......	..	......	97,370,000	1¼ %, Q, Jan.	90⅞	91
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—July 22:						
American Dist. Teleg. (Phila.).....	25	400,000	......	1 % Q.	26	37
Bell Teleph. Co. (of Canada.)	100	3,960,000	3,564,000	2 % S.	188	.
Chesapeake & Potomac Telep. Co..	100	......	......	....	67	70
Chicago Telephone Co	100	......	......	......	200	210
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	148	150
Empire & Bay States Telegraph Co.		......	......	....	75	76
Hudson River Telephone Co.......	109	2,000,000	2,000,000	1 % Q.	120	125
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	122	125
Providence (R. I.) Teleph. Co......	50	......	......	....	96	99
Southern New Eng. Teleph. Co....	100	3,000,000	......	....	...	--

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Authors'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—July 22						
Fort Wayne Electric trust receipts..	..	......	......	....	115	125
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	15	25
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new]...... "	100	18,276,000	18,276,000	1½ % Q., Apr., 1901	252⅞	2 3
T.-H. Elec. Co..T. Secur., Series C.	..	......	......	....	22	28
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	70	70¼
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q., Jan.,	75¾	76
Westinghouse El. & Mfg. Co. rights.	50	11,000,000	8,195,126	......	1¾	1⅞
New York.—July 22						
Edison Elec. Ill'g Co., New York..	100	9,188,000	7,938,000	....	119	120
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	2,000,000	1½ % Oct., '98.	-	..
Edison Ore Milling Co	100	......	......	....	8	12
Electric Vehicle Co..........com.	..	......	......	....	--	--
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.		...
General Electric Co. [new].... "	100	18,276,000	18,276,000	1½ % Q.,Apr., 1901	252⅞	253
Interior Conduit & Insulation Co...	100	1,000,000	1,000,000	....	41	--
‖ Kings Co. El. L. & P. Co.	100	2,500,000	2,500,0 00	A. & O.	116	125
Pittsburg, Pa—July 22						
Allegheny County Light Co	100	500,000	500,000	J. & J.	168	172
East End Electric Light Co	50	300,000	300,000	Q	—	—
Philadelphia, Pa.—July 22						
Edison Electric Light Co	100	2,000,000	......	......	144	144½
*Electric Storage Battery Co..com.	100	8,500,000	......	......	75	80
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	75	80
Northern Elec. Light & Power Co..	10	550,000	550,000	......	13	13½
Southern Elec. Light & Power Co..	10	187,500	187,500	....	30	—
Miscellaneous.—July 22						
Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	......	......	47	48
Missouri-Edison (St. Louis)....com.	..	......	......	....	20	21
Eddy Electric Mfg. Co	25	......	......	....	9	12
Hartford (Conn.) Elec. Light Co....	100	850,000	......	....	190	191
Hartford (Conn.) Lt. & Power Co..	25	175,000	......	....	6	10
New Haven (Conn.) Elec. Lt. Co....	100	100,000	......	....	195	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct.,	103	104
Rhode Island Elec. Protec. Co.......	100	......	......	....	118¼	120¼
Royal Elec. Co. (Montreal)	..	1,000,000	......	1% Q	‡250	251
Toronto (Canada) Elec. Light Co...	100	1,085,000	1,085,000	1¾ % Q	136	138
Thomson-Houston Welding Co.......	100	......	......	3 % S, Dec. 1,	..	100
Woonsocket (R. I.) Electric Co.....	100	......	......	....	105	106

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

‖ Recently acquired the Edison Illuminating Co. of Brooklyn and its constituent company, the Municipal Electric Light Co.

ALLIED INDUSTRIES.

NAME.	Par	Authors'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—July 22						
American Electric Heating Co	50	10,000,000	....	.....	—	—
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh.	—	—
United Electric Securities Co...pfd.	100	......	1,000,000	$3.50 p.sh.	—	100
New York.—July 22						
Consolidated Electric Storage Co...	...	......	....	....	3	12
Safety Car Heating & Lighting Co..	100	......	....	......	150	155
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	..	--
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 % A	113	114
Philadelphia Pa.—July 22						
Electro Pneumatic Trans. Co	10	1,500,000	......	——	2	2½
United Gas Improvement Co..scrip.	50	10,000,000	......	——	..	162
Welsbach Commercial Co.....com.	100	3,500,000	......	——	20½	21½
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	73	75
Welsbach Light Co	5	525,100	......	....	54	55
Welsbach Light Co., Canada.......	5	500,000	......	....	1	1½
Pittsburg, Pa.—July 22						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co...	100	1,000,000	1,000,000	Q	224	225
Miscellaneous.—July 22						
*Barney & Smith Car Co.......com.	100	......	1,000,000	——	20	25
*Barney & Smith Car Co........pfd.	100	......	500,000	2 %	120	129
Billings & Spencer Co	25	......	....	....	82	
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb	54	56½
Johns-Pratt Co	100	....	....	——	105	109
*Pratt & Whitney Co...........com.	100	......	....	——	--	
*Pratt & Whitney Co...........pfd	100	....	......	——	85	90
Stillwell-Bierce Co..............com.	--	....	......	——	--	50
Stillwell-Bierce Co..............pfd.	--	....	....	2 % Sept	65	70
Shults Belting Co	100	500,000	....	....	80	90
St. Charles Car Co		....	....	......	80	85

*Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany N. Y.

Date of Quotation—July 22 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry. Co ....Cons. mtg. 5s	$500,000	427,500	1940	J. & J.	117⅛	......
†The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*116⅛	......
‡Watervleit Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*125	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*124	126
Troy City Railway Co..................1st 5s	....	....	1942	......	*116½	118

‡Interest guar. by Albany Ry. Co.

‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—July 22, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
United Electric Ry. Co...1st mtg. g. 4s	38,000,000	18,000,000	1949	M. & S.	102	102¾
" " " ....income 4s.	14,000,000	....	1949	J. & D.	74¾	75
Baltimore City Pass. Ry..1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	118⅞	
*Baltimore Traction Co......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	119	120
†Baltimore Trac. Co. Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	104⅛	......
†Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	121	121¼
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	101	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	102½	......
†Central Pass. Ry. Co.........1st mtg. 6s.	96,000	117,000	1912	J. & J.	.....	....
†Central Pass. Ry. Co..Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	119	121
†City & Suburban Ry....1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	116	117
†Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	117	......

☞ All of the bonds of the above companies, marked †, have been assumed by the United Railways & Electric Company.

Boston Mass.

Date of Quotation—July 22, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	114	115
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104⅛	106
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	112	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—July 22, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	....	....
†Charleston City Ry............1st mtg. 6s.	850,000	....	....	J. & J.	106	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—July 22, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry..............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¾	2¾
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	108⅛	109
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	96	96⅛
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	106	......
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	......
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	......
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	108	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	......	111
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	101	102
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	....	106⅝	107
‖W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	....	....

†Redeemable at option on 60 da. notice.

‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.

¶Subject to call after Oct. 1, 1899, at $110 and interest.

‖Assumed by W. Chi. RR. Co., lessee

‖Int. guar. by W. Chicago St. RR. Co

Cincinnati O.

Date of Quotation—July 22 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	114½	115
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103½	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	114	......
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	581,000	581,000	1906	M. & S.	108¾	......
So. Cov. & Cin. St. Ry........1st mtg. 6s.	250,000	250,000	1912	M. & S.	121½	122½
‡So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	132¾	137

† Assumed by the Cincin. St. Ry. Co.

‡$250,000 reserved to retire 1st mtg. bds.

Cleveland O.

Date of Quotation—July 22, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S.	106½	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	113½	114¼
Cleveland City Cable Ry.....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	105½	106
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	106	107
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
*a*East Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	......	107½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.

‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—July 22, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,885,000	1905	A. & O.	......	102½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	
The Detroit Ry.................1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	105	106½

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—July 22 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry........1st mtg. g. 5s.	600,000	600,000	1918		111	....
New Haven (Edgewood Div.) 1st. mtg. 5s.	250,000	250,000	1914	J & D	111	......
Winchester Avenue RR—1st mtg. g. 5s.	100,000	500,000	1912	M& N	109	......
-hester Avenue RR......Deben.	g 100,000	24,000	1913	M& S		

New Orleans La.

Date of Quotation—July 22 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.. cons mtg. 6s.	$150,000	$150,000	1912	M. & N.	......	....
Crescent City RR...........1st mtg. 6s.	......	50,000	1899	M. & N.	105½	......
Crescent City RR......Cons. mtg. g. 5s.	5,000,000	3,000,000	1948	J. & J.	......	......
New Orleans City RR........1st mtg. 6s.	416,500	899,000	1903	J. & D.	108	112
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1948	J. & J.	112	113
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	......	......
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	......	......
‡St. Charles St. RR. Co......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	......	......

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.

‡$90,000 outstanding.

New York.

Date of Quotation—July 22 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	......
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107½	110
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	115	116
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	123	125
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	105½
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	108	110
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	115	116
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	101	....
Brooklyn Heights RR.......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	......
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	113	....
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	107	....
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	108½	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	98½	100½
Cent P'k, N. & E. R. RR. 1st cons. mtg. 4s.	1,200,000	1,200,000	1902	J. & D.	107	109
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	125	......
Coney Island & Brooklyn RR. 1st mtg. 5s	800,000	800,000	1903	J. & J.	101	103
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1932	J. & D.	117	120
Dry Dock, E. Bd'y & Bat'y RR..scrip 5%.	100,000	1,100,000	1914	F. & A.	102	105
Eighth Av. RR. Co.....Cert. indebt. 6%.	000 000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	,200,000	1,200,000	1910	M. & S.	116½	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	89	......
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	124	126
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	120	......
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600 000	1909	M. & N.	120	121
Second Avenue Ry..............Deb. 5s.	800,000	800,000	1909	J. & J.	108½	109
Steinway Ry. (L. I.).........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	116	117
South Ferry RR. Co.........1st mtg. 5s.	850,000	850,000	1919	......	110½	112½
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	......	123½
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	.....	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	106	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	116
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	114

†$1,085,000 in escrow to retire gen. mtg. bonds.

‡$4,850,000 in escrow to retire maturing obligations.

¶$552,000 in escrow to retire 1st and 2d mtg. bonds.

§In treasury, $80,000.

‡‡ Guar. by Union Ry. Co.

Toronto Canada

Date of Quotation—July 22 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry..................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.		
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M & S.		

†$35,000 per m. single track authorized $600,000 in escrow to retire 6s due in 1901

Philadelphia

Date of Quotation—July 22 19

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry...........1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	800,000	200,000	1900	J. & J.		....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.		....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......		....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.		....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1948	...	....	....
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J &	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,800,000	1,018,000	1917	F. & A.	......	.....
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co..................Col tr. 4s.	29,785,000	29,724,876	1945	A. & O.	——	......
West End Passenger Ry.......1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	......	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	......	......

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg. Pa.

Date of Quotation—July 22 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	111½	....
Central Traction Co...............1st mtg. 5s.	875,000	875,000	1930	J. & J	......	......
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	....	......
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	110	113
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	113
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	...	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co....................5s.	2,500,000	2,000,000	1934	J. & D.	......	....
Sub. Rapid Transit Railway Co..........5s.	500,000	500,000	1912	M. & S.	......	....

Providence R. I.

Date of Quotation—July 22 901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry..................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	116	118

St. Louis.

Date of Quotation—July 22, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baden & St. Louis RR.........1st mtg. 5s	250,000	250,000	1913	J & J	101½	102½
Cass Ave. & Fair Gds Ry......1st mtg. 5s	1,818,000	1,818,000	1912	J & J	101½	102½
Citizens' Railway Co......1st mtg. 5s	2,000,000	1,500,000	1907	J & J	109	
Comp. Hts. Un. De. & Mer. Ter...1s	1 000 000	000 000	191	J& J	17	

With interest Unlisted

With interest

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis						
Date of Quotation—July 22 1901						
Jefferson Avenue Ry............1st mtg. 5s.	270,000	270,000	1905	M. & N.	102	108
Lindell Ry. Co.....................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	108
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	105	106
‡Mound City RR. Co..............1st mtg. 6s.	400,000	300,000	1910	A. & O.	104½	105½
People's RR. Co....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	....	......
‖People's RR. Co......................2d mtg. 7s.	75,000	75,000	1902	M. & N.	......	......
People's RR. Co................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	......	......
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co......................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	99½	100½
*St. Louis & Sub. Ry.........1st mtg. g. 5s.	3,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry................Income 5s.	300,000	300,000	......	....	80	84
†Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	106	108
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	116½	117½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	100	100½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	121	122
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
*$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. 6s.						
San Francisco Cal.						
Date of Quotation—June 1901.						
California St. Cable RR.....1st mtg. g. 6s.	1,000,000	900,000	1915	J. & J.	114	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	117
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	......	95
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	126¼	......
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	.....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126¼	......
†Park & Cliff House RR........1st mtg. 6s.	350,000	350,000	1912	J. & J.	105¾	107
†Park & Ocean RR..................1st mtg. 6s.	250,000	250,000	1914	J. & J.	115	......
†Powell St. Ry........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	.....	126
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—July 22, 1901						
Belt Ry. Co............................Cons mtg 5s.	500,000	450,000	1920	J. & J.	......	...
Columbia Ry..........................1st mtg. 6s.	500,000	500,000	1914	A. & O.	132	......
Eckington & Soldiers' Home 1st mtg. 6s.	200,000	200,000	1911	J. & D.	......	......
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	......	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—July 22, 1901						
Bridgeport Traction Co.........1st mtg. 5s.	2,000,000	1,688,000	1928	J. & J.	106	110
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	118	. ..
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	104	105
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,866,000	1932	M. & N.	112	113
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	115	....
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	111¼	111⅝
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	115	115½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	20	..
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	85
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	119	119½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	110¼	110¾
††No. Hudson Co. Ry. (N. J.). Cons. mtg. 5s	8,000,000	2,878,000	1928	J. & J.	108	......
No. Hudson Co. Ry. (N. J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	....	......
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	......	......
St. Paul City Ry...................Cons. g. 5s.	5,500,000	4,298,000	1937	....	105½	106
St. Paul City Ry.....................Deb. g. 6s.	1,000,000	1,000,000	1900	....	108	....
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rs	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—July 22, 1901.						
Delaware Gas Lt. Co.,.........1st m. 5s, g.	800,000	800,000	......	J. & J.	106	108
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	157	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	116	......
Pittsburg Pa						
Date of Quotation—July 22 1901						
Allegheny County Light Co..............6s.	500,000	......	1911	J. & J.	110	......
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(July 22 1901.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	109	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1998	......	124	......
Edison Elec. Illg. Co. (Brooklyn).......	5,000,000	5,000,000	1940	....	122½	124
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	. ..	......
Kings Co. El. Lt. & Pow. Co. 1st mtg. 5s.	2,500,000	.....	1937	A. & O.	100	105
Kings Co. El. Lt. & Po. Co. pur. money 6s	5,176,000	....	1997	A & O.	120	122
Milwaukee El. Ry & Lt. Co. 1st con. g. 5s.	8,000,000	....	......	F. & A.	102½	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	.....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—July 22. 1901.						
American Bell Telephone.....................4s.			1908	F. & A.	100½	101
Northwestern Telegraph Co................7s.	....	......	....	......	......	....
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	114	115
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	106

ALLIED INDUSTRIES.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—July 22 1901						
American Electric Heating............7s	500,000	500,000	....	....	....	......
Armington & Sims Engine Co..............	....	....	......	......	......	25
Barrney & Smith Car Co.......................6s.	....	....	1942	J. & J.	106	107
Carborundum Mfg Co..........................6s.	......	....	1904	J & D.	......	......
Worthington Pump Co.........................	75,000	....	......	......	115	127
Unlisted ¶Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 16¾@17c.; Lake, 17@17⅛c. casting, 16⅝@16⅞c.

Investors are reported buying the New York traction stocks at going figures.

The gross earnings of the Chicago Union Traction Company for June increased $60,000.

The Chicago Board of Review threatens to tax the Chicago Edison Company on a valuation of $10,500,000, against $2,750,000 last year.

It is rumored that George Gould and E. H. Harriman will ultimately bring about an alliance between the elevated lines of Manhattan and Brooklyn.

The stock and bonds of the Detroit United Railway Company will shortly be increased to a total of $100,000,000. The stock now amounts to $12,500,000 and the bonds to $11,000,000.

American Railways interests deny that there is any intention of resuming negotiations looking to consolidation with the Electric Company of America, or that better terms are to be offered the latter.

The New York, Westchester and Connecticut Traction Company reports for the quarter ended June 30: Gross earnings, $2,012; operating expenses, $2,181; fixed charges, $89; deficit, $258; cash on hand, $207; profit and loss deficiency. $482,668.

The Consolidated Traction Company, of Pittsburg, reports a surplus of $26,252 for June, an increase of $11,877, compared with the same month last year; for three months ended June 30 a surplus of $40,294 is shown, a comparative gain of $19,459.

The Middletown-Goshen (N. Y.) Electric Railway Company reports for the quarter ended June 30: Gross earnings $12,106; operating expenses, $10,322; other income, $134; fixed charges, $189; net income, $1,729; cash on hand, $1,460, profit and loss deficiency, $5,221.

The directors of the Metropolitan Elevated Railroad Company of Chicago will meet the first week in August for the purpose of declaring the semi-annual preferred dividend While the directors will not announce the amount to be declared, it is generally expected that it will be 2 per cent.

The following are quotations for some of the industrial stocks not quoted else where: Electrical Lead Reduction, 1¾@2½; Electric Boat, 17@19; Electric Vehicle, 6@8; Tel. & Tel. Company of America (full paid), 4@6¼; Electric Company of America, 4@6; National Carbon, 16¾@17.

Insiders, according to the Philadelphia "Stockholder," are accumulating General Electric, but comparatively little is offered. Vague rumors of the re-adjustment of the company's capital are still heard, but nothing definite has yet been done. Wagers are made that the stock will sell at 300 before January 1 next.

The largest mortgage ever filed in the Rochester Clerk's office was filed on the 19th inst. The mortgage was executed by the Buffalo, Niagara Falls & Rochester Railway Company, and is for $3,500,000. It covers the entire assets of the road, including everything of a tangible nature. Sutro Brothers of New York City, bankers and brokers, are the mortgagees. The money will be used to build the road, work on which will be started immediately.

By the action of the directors of the New England Electric Vehicle Company in declaring a dividend, on July 17, of $2.50 per share to stockholders, the company is formally dissolved. As the par value of the stock was $10 per share, the dividend is one of 25 cents on the dollar. The total amount of the dividend will be about $562,000. The number of shares outstanding was 225,120. If all had been paid for in full the dividend would be $562,800. The books of the company closed on July 23.

Thomas A. Edison has purchased a mill near Orange, N. J., for the manufacture of electric storage batteries under his new patents. It is stated that several prominent capitalists have become interested in the $1,000,000 company which Edison has organized, including President Schwab and Director Gary, of the U. S. Steel Corporation who it is said have $50,000 together; H. McK. Twombly $200,000; and Samuel R. Callaway a smaller amount. Only $300,000 of the $1,000,000 stock has been issued to anyone outside of Mr. Edison and a few of his close friends, the $300,000 being given as bonus to the subscribers for the $500,000 bonds.

The Philadelphia "Stockholder" believes that a deal of some character involving the Electric Storage Battery Company is on, and says there is a persistent accumulation of the stocks by strong houses. Nature of the supposed deal is, however, unknown to the general public. Rumors, which are always plentiful, but not always reliable when a movement is on, have it that either General Electric or Westinghouse people are seeking control. The Storage Battery stocks are selling at less than one-half the price at which they were eagerly bought by the Whitney contingent at a time when they were making no dividend returns. The company is now a regular quarterly dividend payer, and is doing a profitable business. Recent buyers of the stocks confidently predict that prices will shortly cross 100. There is no doubt, whatever the nature of the deal is, that a good deal of both common and preferred stocks, formerly held by lighter weights, has found lodgment in strong hands. Referring to dividends, it will be recalled that the company recently paid 1¼ per cent., quarterly, on both issues, being the second at the 5 per cent. rate. This is equivalent to an annual outlay of $818,750, there being $11,875,000 common and $4,500,000 preferred outstanding. Earnings for the first half of the current year are stated to be largely in excess of the rate now paid. For the year ended December 31, 1900, the net income was officially given as $1,317,865.

ELECTRICITY.

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EDITORIAL NOTES.

The Accident to the Brooklyn Bridge.

In the issue of ELECTRICITY of July 24, we referred in these columns to the fact that the Brooklyn Bridge was undoubtedly overloaded. That our surmise was correct was proven on Thursday last by the breaking of a number of the suspension rods, which necessitated for a short time the stopping of heavy traffic over the structure.

When the Brooklyn Bridge was first built, it was intended primarily to carry foot passengers and heavy trucks, but as the years rolled by cable cars were first added, then electric cars, with the result that at the present day far more is exacted from the bridge than was expected by its famous designer. That such is the case may be inferred from a reported interview with Mr. Washington A. Roebling, who said:

"If the bridge had been properly treated I think there would have been no trouble. The bridge is frequently blocked by the trolleys getting out of repair or the elevated trains getting into trouble. This, of course, means the concentration of great weight on the structure."

The recent trouble is claimed to be due in part to the variations in temperature, which caused contraction and expansion. Mr. John Bernard Walker, a bridge expert, is reported as saying:

"The breaks were due to the rusting of the pins of the suspenders in the bearings which fastened them to the bottom cord of the truss. The consequence of this rusting was an enormous frictional resistance to the turning of the pins in the journals in harmony with the oscillations of the suspenders. The direct effect of this friction was to produce a heavy cross binding strain upon the suspenders, which was much aggravated by the fact that these strains were continually reversed as the truss structure moved forward and backward in sympathy with temperamental changes and the movement of the live load. It was only a matter of time when crystallization of the metal set in and the suspenders gave way."

That electrolysis played no part in the breaking of the rods in question is shown by the fact that their position precluded the possibility of there being present any moisture or salts. This view is held by Mr. Edward R. Knowles, the well-known electrical expert, who gave it as his opinion that the accident was of a purely mechanical nature.

In any case the breaking of these rods should serve as a warning and should lead to a careful investigation of the stresses and strains that the bridge is at present subjected to. If the factor of safety is then found to be materially reduced, steps should be taken to strengthen the structure or arrangements made for a more even distribution of the train weights.

* * *

A New Artificial Fuel.

The fact that the coal supply of the world is limited and may not last more than a thousand years or so has stimulated inventors to seek some equally good and economical substitute. The latest aspirant for honors in this direction is a resident of Wilmington, Del., by the name of Morrow. This gentleman is an expert chemist, so it is claimed, and has devoted years to the study of the subject. As a result he has perfected an artificial fuel which, according to a daily paper, will revolutionize the heating business.

This fuel is composed of about 90 per cent. of common earth. For domestic purposes Dr. Morrow thinks ordinary earth, such as is found in back yards, is preferable, while for high draught fires, such as locomotives, steamships and those in central stations, fuel made of clay is preferable, as it hardens better. To the earth is added about 3 per cent. of coal tar, as a protection from the weather. With the coal tar in the fuel it can be exposed to rain for any length of time without being damaged. Dr. Morrow has pieces of his fuel that have been in water from two to three days without being impaired. A trifle of sawdust is added, although it is not necessary. It is merely added to the fuel for domestic use so that it will burn out and make the fuel porous.

To these parts is added the secret compound, which, Dr. Morrow says, "I have back of my ears, and I will keep it there until somebody pays me for it."

The fuel with which a demonstration is said to have been made was manufactured in a hand mould in Dr. Morrow's laboratory. It was in the shape of small bricks. Each weighed three ounces. When placed on a fire they burn with an intense heat. According to the experiments the artificial fuel under an ordinary draught such as used in houses will burn from four to six hours. Under a forced draught it will last from two to four hours longer than coal.

Another point in favor of the fuel is that it throws off no smoke, gas or vapor. When first placed on a fire it takes about ninety seconds for the coal tar in the bricks to be consumed, and after that there is not the slightest odor, but the fire burns intensely with a small blue flame.

As to the cost of manufacture Dr. Morrow has made what he considers a liberal estimate. With earth costing practically nothing, and coal tar very cheap, there remains but the secret ingredients, which, according to the inventor, are inexpensive staple articles. Dr. Morrow, in his estimate of manufacture, has figured the cost of a plant, the cost of hauling the dirt, a big interest on the invested capital, and says the fuel can be easily manufactured for 50 per cent. less than coal now costs.

If such is the case the new fuel will be welcomed by central station managers the country over. Unfortunately, we have heard before—for a very limited time—of wonderful new artificial fuels.

* * *

Our Exports to Italy.

A perusal of the official table of exports for the past two years shows that Italy is quite an important market for American electrical manufactures. During the fiscal year 1900 the exports of electrical machinery to that country amounted in value to $65,108, being a decline from those for the previous year, when the exports were valued at $79,450. This decline, however, is more than made up in the shipments of instruments and apparatus for scientific purposes, including telegraph, telephone and other electric apparatus, for the fiscal year 1900, the total shipments amounting to $124,966, against $18,889 for the previous fiscal year.

The great mistake of many American exporters has been to consider Italy as not worth dealing with directly. It should be remembered, however, that Italy has certain industries which necessitate the use of much material and many tools. Among other things that are made and exported are all kinds of engines, boilers, motors, electric machinery, etc. Therefore, if American houses wish or expect to supply Italy, it would be advantageous to deal direct and not, as too often heretofore, through some other country. The custom of giving to some European house the control of the whole of Europe, or to one country the control of another, is not always beneficial. Paris, Berlin or Brussels cannot successfully supply Italy with American goods, as Italy is a difficult market to deal with, and, in addition to the extra trouble, Italians refuse to pay double freight rates and duties.

The selection of agents is very important. They need not necessarily be Italians, but they must be men who understand the goods they are required to handle, and know the business customs of the country, and are capable of pushing their articles in the right direction. The agent must sell and be up-to-date, but he must also obtain the concessions from the American exporter that he gets elsewhere.

The business men of Italy were much impressed with the excellent manner in which American manufactures, especially electrical manufactures, were exhibited and explained at the Paris Exposition. The trouble, care and courtesy there shown are just as necessary in the narrower sphere of a manufacturer dealing with his agent, or of an agent with his customers.

Under the provisions of the Italian tariff law, dynamo electric machines weighing more than 1,000 kilograms pay a duty of $3.09; those weighing 1,000 kilograms or less pay $4.83. Electric storage batteries are dutiable at $1.54, while detached parts of dynamo electric machines are subject to duty at the rate of $4.83 per quintal. Electric wires and cables, formed with one or more metallic conductors, no matter how covered with textile material and varnished, also with gutta-percha or india-rubber, pay duty at the rate of $11.58 per quintal. Electric cables, including submarine cables, are dutiable at the rate of $5.79 per quintal.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

Dr. Henry Pritchett, superintendent of awards at the Pan-American Exposition, has announced as jurors in the department of electrical exhibits: Carl Hering, chairman; F. B. Crocker, A. V. Abbott, D. C. Jackson, W. S. Franklin, W. S. Barstow, W. E. Goldsborough, A. E. Kennelly, Henry S. Carhart and William L. Puffer.

Last week the London County Council voted to send a tramways manager and an electrical engineer to the United States to investigate street railways, especially the "shallow underground lines" of the Boston system, which it is proposed to copy there.

The Fair Haven and Westville (Conn.) Railroad Company has installed an electric patrol at the Meadow street car house, which is undoubtedly of a great deal of value in the quick response to emergency calls to repair damages to the electrical equipment of the road at any place and at any time of the day or night.

The city of Moscow, Russia, is making use of ozone for sterilizing its water supply. The purification of the water in this way is simply a development of and an improvement upon the ordinary aeration of water by means of atmospheric air. The air, before coming in contact with the water, is subjected to a series of electrical discharges which convert the oxygen from diatomic oxygen to triatomic oxygen, which is ozone, and is remarkable for its power of oxidizing organic matter including the bacteria in water. The cost is put at $6.25 for each million gallons, or in large plants even less.

It is understood that the electric railway between Le Fayet and Chamonix in Switzerland was opened on July 25.

The Hamburg-American liner Deutschland, which is the biggest mail steamer afloat, possesses a very complete installation of electric light and power, the handiwork of the Allgemeine Electricitäts-Gesellschaft of Berlin, says "Lightning," London. By subdividing the generating plant and arranging the circuits for feeding from more than one source, every precaution has been taken against failure of the supply. Altogether some 2,550 glow lamps and 23 motors have been installed; and the generating plant comprises five steam dynamos, three being of 80 kw. capacity each, and the others of 45 kw. Four of the sets are placed behind the main engine room; but the fifth, one of the larger sets, is situated on the main deck, above water level, though it is easily accessible from the engine room. Thus should any accident flood the lower part of the vessel, there would still be light at a time when it would be badly needed. The main circuits are three in number, namely: the pilot lighting circuit, which feeds all signal lamps and those essential for safety and for the running of the vessel, for instance, lamps in the engine and boiler rooms; the general lighting circuit which supplies the remaining lamps; and lastly, the power circuit. Since July last year the plant has been in continuous operation without a breakdown.

Marconi's Wireless Telegraph Company, Limited, has brought suit against Frederick J. Cross, manager of the Inter-Island Telegraph Company in the First Circuit Court at Honolulu, H. I., for $5,500 and £500 sterling, which the company claims is due it as the second payment of $11,000 for installing the system of wireless telegraph now in operation between the various islands of the group from Oahu to Hawaii. The company, by its attorneys, Kinney, Ballou & McClanahan, states that on October 31, 1899, the plaintiff and defendant entered into a written agreement. The name of their corporation was then the Wireless Telegraph & Signal Company, Limited, which was changed later to Marconi's Wireless Telegraph Company.

According to advices from abroad an Italian by the name of Olivetti has lately placed on the market a device for protecting electrical instruments, which consists of a silver spring connected to one of the terminals. When the pointer of the instrument passes the maximum reading it presses this spring against a small stud connected with the other terminal, so that the instrument is short-circuited.

The engineers of the Canadian Pacific Railway are now studying means of utilizing the enormous water power that is within reach of the road where it crosses the Rocky Mountains. It is with the greatest difficulty that the trains of the company are drawn over the mountain ridges by steam locomotives, it being necessary in most cases to break them in two and add a "pusher" engine to each section. This is not only an expensive system, but it is slow, and it is understood that plans for installing electricity instead have progressed so far that contracts for the requisite plant are soon to be signed.

President J. L. Greatsinger of the Brooklyn Rapid Transit Company has approved of the plans for the erection of emergency stations in various parts af the territory covered by the extensive trolley and elevated railroad systems. The stations will be of a uniform height of two stories, 31 feet wide and 75 feet deep, and each will have an emergency crew of five men, horses and apparatus. The first station will be in Flushing avenue, between Nortrand and Marcy avenues. Work on it has begun and the station will be completed before the close of the year. The second station will be at Coney Island, and the third at Ridgewood. Mr. Greatsinger says that when the emergency stations are in full operation all mishaps on the line will be attended to much more promptly than at present.

THE American Electro-Therapeutic Association will hold its eleventh annual convention in Buffalo, on September 24, 25 and 26. Its headquarters will be at Hotel Niagara, and its place of meeting, at the armory of the 74th regiment.

BETWEEN the steamship Kaiser Wilhelm der Grosse of the North German Lloyd line, and the Cunarder Lucania a successful test of the operation of the Marconi wireless telegraph system was made on the afternoon of July 27, in the water of New York harbor. The Lucania sailed for Liverpool at one o'clock in the afternoon, while the Kaiser Wilhelm der Grosse remained berthed at pier 51, North River. For more than an hour the two vessels were in constant communication with each other, and until the Lucania passed out of the Narrows there was no difficulty in reading her signals.

NEW street car fenders that fend are in great demand, and many minds are turned, in nventive bent, to discover the real thing in this respect. Mr. Philip Trudell, of Toronto, Ont., has been working on a fender which promises well. The feature of his fender is that the front part of it is divided into two parts, hinged together, so that when it meets an obstruction, the outer part automatically drops on the rails, catches the obstruction and brings it on the fender. In conjunction with this is an automatic sand sifter, which works with the hinged fender and aids in bringing the car to a sudden stop.

As electricity is rapidly assuming its position as leader of the methods of propulsion, a scheme is being put underway whereby Buffalo, Albany and New York shall be connected by an unbroken line of rails and wires across New York State. Eventually it is probable that Boston will be the eastern terminus of the system. Beginning at Buffalo, that city will soon be connected with Rochester by the Buffalo, Niagara and Rochester Electric Railway, which will follow the line of the Ridge Road. Later it is understood that the Buffalo and Williamsville road, which is building its line to Batavia, will throw out an extension to Rochester.

THE methods at present employed in the process of tanning hides are remarkably lengthy, says the London "Electrical Engineer," and include circulating the tan liquor so that fresh portions are continually presented to the hide, forcing the liquid through the hide by pressure and using strong aqueous extracts of tanning materials. The "Electro-Chemist and Metallurgist" describes one or two processes by which it is sought to attain the same object by passing a current of electricity through the vats in which the hides are suspended. One of these is Groth's process, which, it is said, has been found to shorten the time of tanning to a quarter of that required when no current is used. In this device the tan liquor is contained in a tank in which is a frame carrying hides, and capable of being moved to and fro, or rotated so as to bring the hide continuously into contact with fresh liquor. Copper electrodes are placed at the side of the tank. For a vat holding 1,500 gallons a current of not more than four amperes is used. The current density is not more than one-tenth ampere per square foot of transverse section of the vat. With this mild stimulus it was found that the rate of tanning was 16 times as fast as when the hides were simply immersed in the tan liquor and allowed to be stationary, and four times as fast as when the hides were moved and no current passed.

IT has been suggested that the general introduction of electric railways in the country-side will eventually arrest the tide of country population flowing towards the cities. The advent of the steam railways had no such effect. On the contrary, it made the cities more accessible to country residents, contributing greatly to the growth of the immediate environs of the cities. The electric lines will relieve the isolation of country living, and prove a great boon to farmers, but that they will check the growth of the towns and prevent the denudation of the rural countries is improbable. The next census ought to throw some informing light on this question. The rapid improvement of city districts at some distance from the business quarter since the introduction of the electric street railways, and the remarkable increase of suburban settlements sooner or later to come within the limits of the neighboring city, show that cities have reaped great advantages from the new method of street transit. The trolley lines rapidly extending into the country in every direction are so many new pathways to the great towns. The tendency of the people to herd together in villages, which develop into towns and cities, has been noticed for hundreds of years, and the tendency seems to increase with improving means of communication.

WE desire to acknowledge with thanks the receipt of a neatly gotten up dating stamp, sent us by Baker & Co., of Newark, N. J. This little piece of mechanism cannot fail to prove extremely useful.

PAN-AMERICAN SCENES AND EXHIBITS—III.

BY FRANK C. PERKINS.

So much has already been given in the columns of ELECTRICITY in reference to the details of constructions, wiring and illuminating effects of the Electric Tower at the Pan-American Exposition, that it would be superfluous to attempt any detailed information at this time. The illustration produced on page 315, of ELECTRICITY of the issue of May 22, was the latest scene at that time, giving the electrical effects at night. The accompanying illustrations Figs. 1, 2 and 3, however, show the marvelous beauty of the fountains, basins, and statuary by day and the same view by night, since the completion of the fair. The first scene, Fig. 1, shows the Tower in the distance from the Esplanade, taken during a crowded day. The illustrations, Figs. 2 and 3, show the artistic grouping of the lights and the fountains playing with the projector operating upon the water gushing from the niche from the tower.

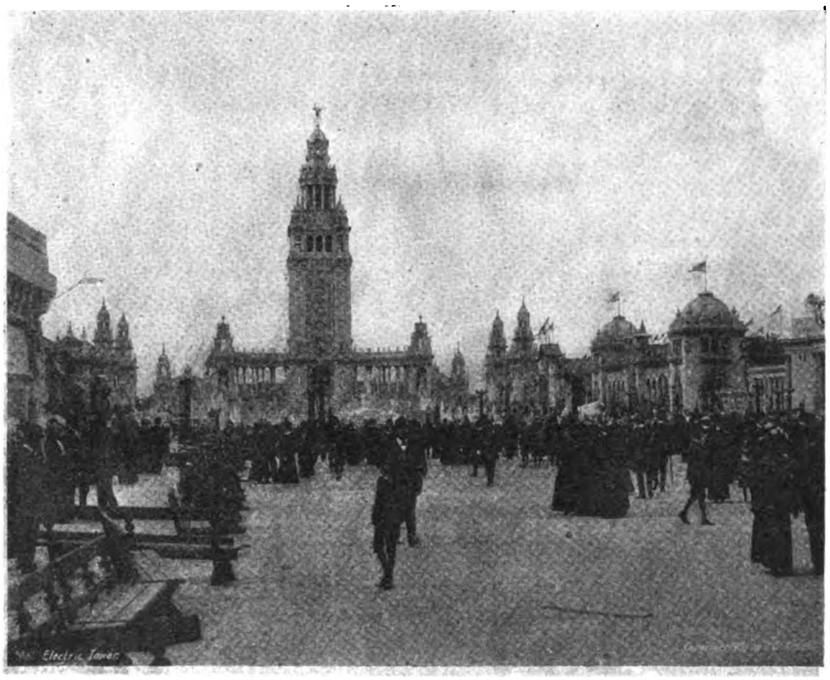

FIG. 1.
Electric Tower from Esplanade, Pan-American Exposition.

Much criticism is heard from every side on account of the slowness in getting the Electric Tower fountains and water effects in operation at night with the beautiful color effects possible with the hundred or more searchlights and projectors under the fountain basin for this purpose.

The Electric Fountain at the lake front is in operation nightly and is very attractive, many features of which are new and interesting, and will receive further attention later when it is hoped to illustrate the fountain when in operation.

The exhibit shown in the accompanying illustration, Fig. 4, is that of the American Electric Telephone Company of Chicago, Ill. It is located on one of the center sections of the Electricity Building on the side toward the Electric Tower. The pavilion is artistically decorated, having Corinthian columns, and built in Colonial style. A large number of telephones are shown with the various switchboards and devices marketed by this firm. The standard power board with central energy system is particularly interesting, and is fitted with ammeters, voltmeters, switches and cutouts required for proper manipulation. The current is supplied by a Roth motor generator, receiving a 500 volt direct current at 3 amperes and delivering a 25 ampere current at 60 volts potential.

Many types and designs of instruments are shown by Mr. S. J. Bear, general Western agent, who has charge of the exhibit. All readers of Electricity visiting the Fair are cordially invited by Mr. Bear to inspect their various devices if opportunity affords.

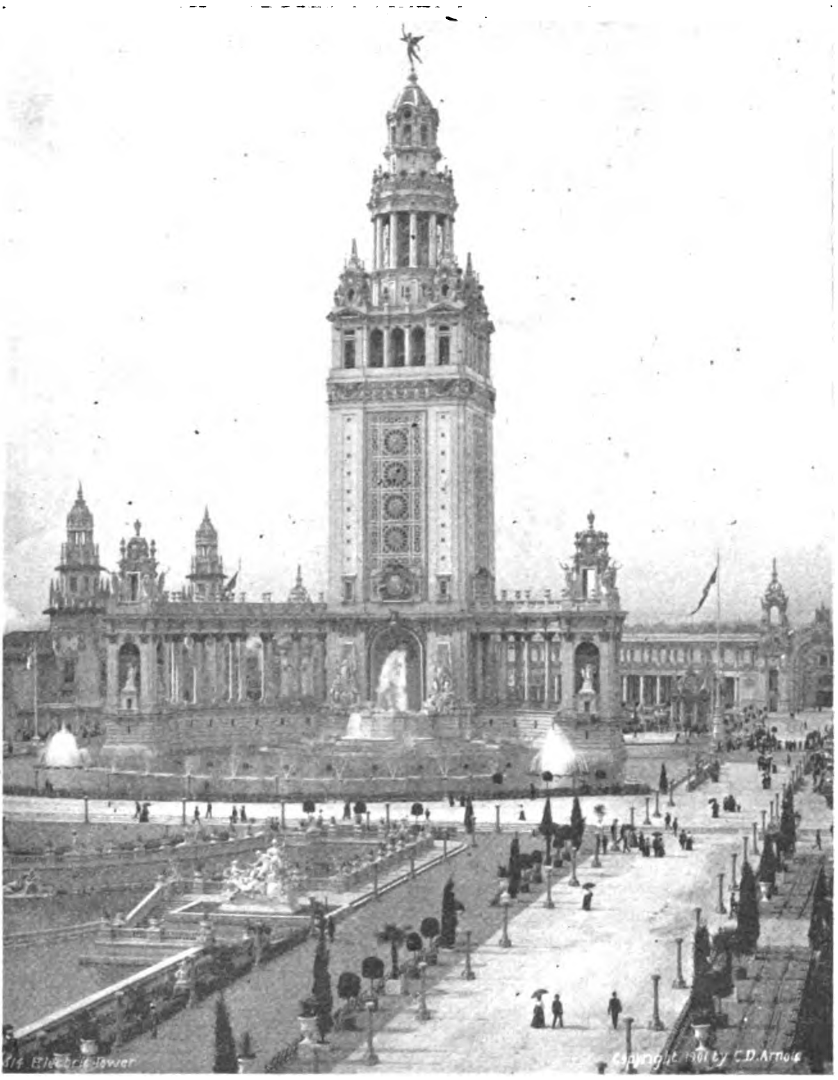

Fig. 2.
Day Scene of Completed Electric Tower, Pan-American Exposition.

The scenes for the next issue will be a grand view of the Central Court, south from the top of the Electric Tower, the completed Mines Building, and a bit of night scenery at the Propylæa.

Value of Electric Roads.

Sir Hiram Maxim, speaking in London on July 26 at a meeting of the Maxim Engineering Company, said electric railways were revolutionizing American city life and property values, whereas Great Britain was deplorably behind in the matter of electric traction, which has spread out populations and mitigated some of the greatest evils of modern cities. He also asserted that light electric roads were capable of 120 miles an hour; that their construction was perfectly practicable, and that their cost would be cheaper than that of the present steam lines.

MISCELLANEOUS NOTES OF INTEREST TO CENTRAL STATION MEN.—III.

BY W. H. WAKEMAN.

If a flange union is leaking steam and there is good reason for believing that the packing is not held as tightly as it might be, it is very natural for an engineer to seize a wrench and try to tighten up some of the nuts, without waiting to shut off the pressure. This is a dangerous practice, for as soon as one nut is screwed down more than the others, that bolt is subjected to more than its share of the stress, and sometimes it will give way under the abuse, the consequence of which is that the others are in turn caused to carry more of a load than they were intended for, and there is danger of the entire joint failing. Some of our plants are run for so many hours per day that it is difficult to find time to shut off steam and make repairs, but it is better to let the packing blow out of a joint than to run the risk of taking human life by screwing nuts up under a heavy pressure.

The cast-iron doors in the rear wall of a tubular boiler setting are usually made so that a slight pressure from the inside will blow them open. The object in making them so is to allow a kind of safety valve action when the hot gases burn so fast that they explode (to use a common term), and it is a good idea to have such a vent, because without it some of the setting would surely be damaged sooner or later. Where the rear doors do not open easily, the furnace doors are sometimes thrown open quickly, and this is neither safe nor pleasant for the fireman. It is a bother to shut these doors occasionally, or to be unable to make steam when they are open, and not know what the matter is, still it is not a good plan to fasten them so that they cannot open easily.

When engineers are being examined for admission into engineering societies, they are sometimes asked the following question: "What are the first duties of an engineer, on taking charge of a steam plant that he is not familiar with?" The reply usually is that he should become thoroughly acquainted with the engines, boilers, pumps, etc., as soon as possible. This is proper, but I sometimes think that it would be well to study the peculiarities of the owner, or the superintendent in order to know how to manage the "boss" as well as to manage the machinery that he owns. More than one good engineer has failed to hold his position because he neglected to do this, and others should profit by their example.

It is necessary for an engineer to feel of the crank pin of his engine while in motion so as to know whether it is heating or not, and there is some danger of getting hurt while so doing, but if it is done right this danger will be reduced to a minimum. I have seen an engineer stand opposite the end of the crank shaft and catch the pin as it was at the highest point of its travel, but it appears to be about the worst plan that can be adopted. It is much better to stand just beyond the farthest point it reaches, and hold the hand so that the pin will pass across it, for there is little danger in such a course, even with a high speed engine. This refers to the side crank type, but it may be applied to the center crank kind by letting the strap wipe across the hand instead of the head of the pin.

Every engine should be fitted with a good sight feed lubricator, so as to put cylinder oil in drop by drop, but it should also be furnished with a small hand pump so that if a glass breaks, or the lubricator fails to work from any other cause, it will not be necessary to shut down the engine for lack of oil. The art of making lubricators has reached a degree of perfection which makes them almost positive in operation, and there is little danger of their being broken, but it is the unexpected which sometimes happens, and when the engine has been shut down for a few minutes the cost of lost time will equal the cost of a pump, and in such a case the money goes without providing the pump. If it is secured in advance, when the lubricator is disabled there will be no interruption of the service and the prevention will prove much better than a cure.

When three or four heavy belts lead off from a shaft in one direction, it brings a strong pull on the bearing, which will create excessive friction and wear out the boxes rapidly. The careful engineer or millwright will avoid this as much as possible by having the belts lead off in opposite directions, so that the weight of one belt will offset that of another, and thus relieve the bearings of much stress. It is not always convenient to do this, and while trying to overcome the difficulty an engineer invented the idea of locating a crescent shaped magnet as near to a pulley as possible, so that its attraction would counteract the pull of the belt. If it could be arranged so that one would just offset the other, it might work well, but I have never heard of its being accomplished.

I wish to suggest that whenever a steam user contemplates buying a new and untried kind of boiler, he should pay particular attention to the means provided for keeping it clean. A boiler may be safe under a high steam pressure, and it may be capable of developing much more power than its rating calls for, but if it cannot be easily cleaned it will not prove successful, for although it may show very good results when new which means when it is clean, it will soon become coated with scale, and therefore will not be economical in the use of fuel. Dealers in boiler compounds may exaggerate the bad effects of scale in steam boilers, but after making all due allowance for their enthusiasm, there is still proof that an accumulation of foreign matter here is both costly and dangerous.

FIG. 3.
Night Scene of Completed Electric Tower, Pan-American Exposition.

Occasionally an engineer may be found who tries to save expense when putting a small auxiliary engine into his plant, by using a smaller steam pipe than the cylinder calls for, also by making the exhaust pipe one or two sizes less than the engine builder intended. This plan may be satisfactory so long as the engine is not worked up to its full capacity, but when a full load is put on it, the initial pressure will be much less than boiler pressure, and it will grow less as the piston advances, because the small pipe cannot deliver steam enough to maintain it. The small exhaust pipe may be sufficient to conduct the steam away without causing much back pressure, but this cannot be known until the indicator is applied. The result of this is that the engine labors, the machine that it runs is not kept up to speed, and the whole arrangement is unsatisfactory.

ON A FORM OF ARTIFICIAL SUBMARINE CABLE.*

BY AUGUSTUS TROWBRIDGE.

In teaching the principles of electricity and magnetism, I have often felt the want of some form of artificial submarine cable to illustrate the effect which capacity has on the propagation of electric disturbances along a conductor.

From conversations I have had with some of my fellow physicists, I have come to the conclusion that a description of a simple piece of apparatus designed to imitate the action of a submarine cable may be of interest to teachers of physics.

From the so-called telegraph equation we have that the time which must elapse from the closing of the "home end" of a circuit possessing capacity until the potential at the far end shall have risen to a certain fraction of its final value varies as the product of the resistance and capacity of the system. Stated another way: For different lengths of the same cable the time-lags in signaling vary as the squares of the length. Of course the actual values of the time-lags depend largely on the sensibility of the galvanometer used to detect the signals.

It is customary to look upon a cable as a long Leyden jar whose inner and outer coatings are respectively the conductor and the sea-water and in which the guttapercha sheathing is the dielectric. When one end of this system is put to the pole of a battery, the other pole of which is earthed, the first element of the conductor assumes the potential of the battery, while elements further from the home end still have their original potentials. The potential at any point on the cable rises, at first very rapidly and then more slowly, until after what is theoretically an infinitely long time has elapsed a stationary state is attained when the potential at any point depends only on the resistance of the circuit and the applied electromotive force.

It is during the variable period that the capacity of the system makes itself felt and that quantity together with the resistance is what determines the time-rate of variation of the potential at any point.

The time rate of variation of the current strength at any point may be calculated if the variation of the potential is known. In non-mathematical language the way in which the current varies may be outlined thus: The uniform current strength in the conductor after the variable period is over and the steady state has set in is determined by the electromotive force of the battery and the resistance of the cable.

During the variable period the same quantity of electricity must be in motion as in the steady state, but as a great portion of this is employed at first near the home end in charging the dielectric sheathing, the current in the first elements will be far above that which will exist uniformly in the whole conductor after the steady state, has set in. For this reason, the current strength at the far end will have a value far below the final value. During successive time intervals the current will fall at the home end and rise at the far end where the galvanometer will be affected as soon as the current strength has reached a value at least equal to the figure of merit of the instrument.

In order that an artificial cable shall have an appreciable time-lag, both the resistance and capacity of the system must be great.

The necessary capacity of at least several hundred microfarads is rarely, if ever, to be found in the equipment of a department of physics, on account both of its bulk and expense, if it is of the ordinary tin-foil type.

In designing the apparatus described in this paper it was my aim therefore to make some inexpensive substitute for the ordinary form of capacity play the same role in the artificial cable that the guttapercha sheathing does in the actual cable.

I naturally endeavored to make use of the great polarization capacity which a cell consisting of dilute sulphuric acid with platinum electrodes shows when the applied electromotive force has a value less than the maximum polarization of the cell.

The first to notice the great polarization capacity of electrolytic cells was, I believe, Mr. C. F. Varley who states in the Philosophical Transactions of the year 1872 that the capacity per square inch of platinum plates in dilute acid varies between 175 and 542 microfarads for charging electromotive forces varying between 0.02 and 1.6 volts.

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*From the "Physical Review."

In 1860 Mr. Varley constructed an artificial cable, for the Atlantic Telegraph Company that wished one with which to demonstrate the feasibility of the submarine cable. I have been unable to find any description of this artificial cable, but from references to it by Mr. Varley's contemporaries I infer that it was equivalent to a cable 1,200 miles long and that tin-foil capacities were used. Mr. Varley seems to have recommended the use of electrolytic condensers, though as far as I can find he did not himself use them in the construction of a cable.*

The way in which the energy is stored up in the ordinary form of capacity and in an electrolytic capacity is, of course, very different, but the effect of each in an electric circuit is the same and therefore in constructing a piece of apparatus to imitate the action of a submarine cable it is surely legitimate to use electrolytic capacity.

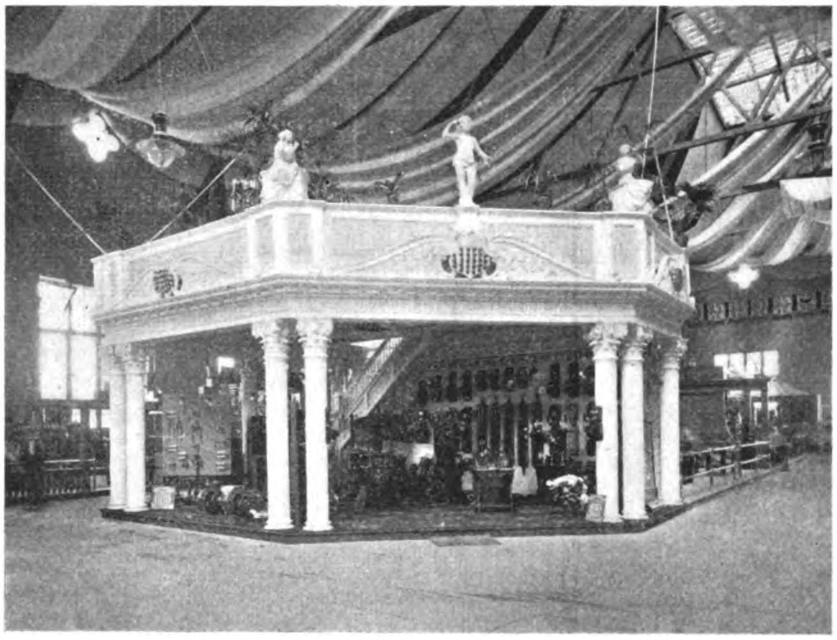

FIG. 4.
Exhibit of the American Electric Telephone Company of Chicago at the Pan-American Exposition.

In a cable the capacity is distributed uniformly along the conductor while in an artificial cable we can only approximate this distribution by connecting the capacities as shown in the accompanying diagram.

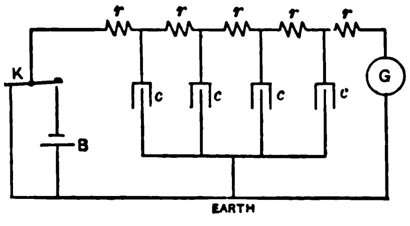

FIG. 1.

In the figure B represents a battery one pole of which is earthed, the other pole being connected to the double key K. This key serves to connect the conductor, which is represented by the resistances r, first with the battery and then with the earth. The capacities which play the role of the dielectric sheathing are connected as shown. G is the galvanometer used to detect the arrival of a signal.

The electrolytic capacities which I used consisted of short lengths of glass tubing about 1 cm. in diameter with a platinum wire as an electrode sealed in to one end. The tube was filled nearly full of distilled water and the other electrode, which was a piece of platinum foil about 3 mm. wide, was corked in so as to dip about 5 mm. into the water.

In the cable which I have made I used 39 such cells arranged in 13 sets of 3 cells each. The 3 cells of each set were connected in parallel in the positions marked c in the diagram. The 13 resistances rr aggregated about one million ohms. The galvanometer had a figure of merit of 10^{-8} amperes which made a signal to consist of a small but very marked throw of the instrument.

It will be found convenient to mount the cells on a thin board in which a triple row of holes are drilled just large enough to allow the wire electrodes to project a few millimeters from the under side and to have this board rest on another in which are three troughs filled with mercury to serve as an earth connection for all the wire electrodes.

In this way if the board carrying the cells be lifted all the capacity is at once removed from the system and a signal is sent along the conductor with no appreciable time-lag. In other words, when the board is lifted the submarine cable becomes an overhead land line of the same length as the cable.

With the apparatus as here described the time-lag when the capacities are in, is very appreciable, being in the neighborhood of six seconds.

Of course the electromotive force of the battery used must be less than the maximum polarization of platinum electrodes in water and therefore a single Daniell or Leclanché cell is suitable.

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*Since writing the above I have succeeded in finding a description of Varley's artificial cable in the "Notices of the Meetings of the Royal Institution," Vol. V., 1866-1869. The inference I drew from other sources as to the nature of the capacities used appears to be correct.

* * *

It is announced that the New York and New Jersey Telephone Company has practically completed a special telephone line between New York and Philadelphia.

UNIFORM SYSTEM OF ACCOUNTS.

Report of Committee on a Standard System of Accounts for Electric Lighting Companies.

The committee appointed by the National Electric Light Association to prepare a uniform system of accounts—consisting of G. E. Tripp, chairman, W. M. Anthony and W. F. Ham—made the following report, which has just been sent out in pamphlet form to members:

To the National Electric Light Association.

Gentlemen:—Your Committee on Uniform Accounting, in submitting its report for your consideration, presents the following explanatory notes in a manner as brief as is consistent with clearness.

GENERAL PLAN ADOPTED.

The classification is divided into three parts:

First—Classification of income (receipts).

Second—Classification of construction (installation and equipment accounts).

Third—Classification of expenditures.

The classification herewith submitted aims to reduce the number of accounts and so to classify same that it will be feasible for the smaller companies to use the classification as submitted, and equally possible, by a further subdivision of the accounts herein named, for the larger companies to conform to and follow the lines laid down.

Your committee has endeavored to arrange those accounts that are in common with street railways, such as operation, power stations, etc., to conform with the general system of street railway accounts as adopted by the Street Railway Accountants' Association; the principal reason for so doing being that there is a constant and growing marked tendency throughout the country toward a consolidation of street railway and electric lighting enterprises in the same towns or cities, and as the number of these consolidated or combined companies is constantly on the increase, it has become necessary to consider a classification of the expenses of an electric lighting company that should conform in the principal essential matters with the classification of expenses of a street railway company.

Your committee recognizes the fact that a classification of accounts can be arrived at by a committee of operating officers with, if not more, perhaps as much intelligence as is possible by a committee of accounting officers, and your committee believes the classification herewith submitted to be promulgated as much from the standpoint of the practical operating official as from the standpoint of the practical accountant, with possibly the added feature that in the classification herewith submitted your committee has gone a little farther than would the practical officer, in so far that your committee has considered a classification that would adapt itself to a simple and direct method of accounting, as well as commend itself to the practical operating official.

Your committee also considered at some length the requirements that are likely to exist for information as to the cost of the maximum demand system of charges, but has thought it best not to include in this report the consideration of a classification in connection with the maximum demand system, but to consider same at some later date.

Your committee, in deciding upon the means and methods to be used in the accounting branch of the business, was confronted by a great array of blank forms, an examination of which showed that not only did the blanks themselves differ as between different companies, but that some companies had carefully prepared blanks to cover information that other companies seemed to provide for without any blanks whatever; but upon careful consideration your committee thought it wiser to confine the present report simply to a classification, as the committee felt that more progress would be made by taking up one step at a time rather than submitting a report that would possibly defeat its very object by being too voluminous in its scope and intention, it being thought wiser to leave the question of forms and methods either to a subsequent committee or to further action of the same committee, or whatever may be the pleasure of the association.

Your committee has also borne in mind the value and necessity of a classification that would be well adapted to meet the demands made upon it in the compiling and computation of statistics such as costs and incomes per kilowatt hour, etc.

A standard system of blanks and bookkeeping methods is a subject that should receive very careful attention, and should be the concensus of opinion resulting from a broad discussion of the subject. Each particular step is one to be carefully considered and from many different view points, and in submitting to the convention a report on a standard system of bookkeeping methods, your committee, owing to a change in its personnel, has not had the time to consider the subject as carefully as a report on the same would warrant.

In connection with this report, your committee wishes to acknowledge the obligation furnished it by the report of the committee on a standard system of street railway accounting.

CLASSIFICATION OF INCOME.

Municipal light { Incandescent.*
{ Arc.*
Commercial light { Incandescent.*
{ Arc.*
Municipal power service.
Commercial power service.
Railway service.
Merchandise sales and job work billed (net profits).
Rentals.
Miscellaneous receipts.

LIST OF CONSTRUCTION ACCOUNTS.

A. Organization.
B. Royalties, Franchise and License.
C. Real Estate and Buildings.
D. Water Power Plant.
E. Steam Plant.
F. Electrical Generating Plant.
G. Sub-station Installation (Storage Battery, Rotary Transformer, etc).
H. Street and Service Installation (Overhead).
I. Street and Service Installation (Underground).
J. Arc Light Installation.
K. Meter, Meter Appliances and Line Transformer Installations.
L. Tools and Instruments.
M. Office Furniture and Fixtures.
N. (To be reserved for future use).

ACCOUNT A.

Organization includes all expenses incurred in effecting organization, and such capital exploit expenses as may be properly connected therewith, including such legal expenses as are directly incurred by reason of the organization of properties or the acquirement of properties.

ACCOUNT B.

Royalties, Franchise and License.—Includes all royalties or licenses paid to licensors and the amounts represented or paid for in connection with city, town and other franchises.

ACCOUNT C.

Real Estate and Buildings.—Includes all land, buildings, sheds, docks, wharves and fences, together with brick stacks, traveling cranes, elevators, and such investment costs as can be considered a part and parcel of the building,

ACCOUNT D.

Water Power Plant.—Dams, canals, tail races, head gates, penstocks, wheel gates, wheel governors, water wheels, etc.

ACCOUNT E.

Steam Plant.—(a) Includes boilers with settings, and steel stacks belonging with boilers, provided such stacks can be easily removed without injury to the building. (b) Includes engines with settings. (c) Pumps, heaters, condensers, tanks, piping, etc., shafting, belting, conveyors and economizers.

ACCOUNT F.

Electrical Generating Plant.—Includes dynamos, switchboards with instruments, and all other electrical equipments located in generating stations, together with station wiring.

ACCOUNT G.

Sub-Station Installation (Storage Battery, Rotary Transformers, etc).—Includes all installation of storage batteries, motor generators, step-up and step down transformers, tub transformers, rotary converters, including regulators and switchboards, together with equipment directly connected with same, which can in any way be considered a part and parcel of the sub station plant.

ACCOUNT H.

Street and Service Installation (Overhead).—Includes poles, wires, cross arms, mast arms, and all installation expense connected with overhead main lines or services in connection therewith.

ACCOUNT I.

Street and Service Installation (Underground).—Includes conduits, cables, underground conductors, junction boxes, manholes, and all installation connected with underground mains or services.

ACCOUNT J.

Arc Light Installation.—Includes only the actual cost of arc lamps, globes, nets, arresters, hoods and rods installed. (No labor to be charged to this account.)

ACCOUNT K.

Meter, Meter Appliances and Line Transformer Installation.—Includes actual cost of meters, meter appliances, transformers installed to outside lines. (No labor to be charged to this account.)

ACCOUNT L.

Tools and Instruments.—Includes boiler-room tools, engine-room tools, linemen's tools, meter, arc lamp and other repair tools, tools for maintenance of dams, and all portable testing instruments. All tools bought to replace worn out tools, implements and testing instruments, should be charged to the proper operating or maintenance account.

ACCOUNT M.

Office Furniture and Fixtures.—Includes all desks, letter files, record cases, typewriting machines, and all such equipment as may be considered a part and parcel of the furniture and fixtures in the general offices of the company.

LIST OF EXPENSE ACCOUNTS.

Cost of Manufacture (Generating.)

Operating.—1, Power plant wages; 2, Fuel for power; 3, Water for power; 4, Lubricants and waste for power plant; 5, Miscellaneous supplies and expenses for power plant; 6, Hired power; 7, To be reserved for future development.

Maintenance.—8, Maintenance of boilers; 9, Maintenance of engines; 10, Maintenance of electric plant; 11, Maintenance miscellaneous station equipment; 12, Maintenance buildings and fixtures; 13, Maintenance dams, canals and tail races; 14, Maintenance of gates, wheels and governors; 15, To be reserved for future development.

Cost of Distribution

Operating.—16, Operating arc lamps; 17, Operating meters; 18, Renewal of incandescent lamps; 19, Operating sub-stations; 20, Miscellaneous distribution operating expenses; 21, To be reserved for future development.

Maintenance.—22, Maintenance underground system; 23, Maintenance overhead system; 24, Maintenance arc lamps; 25, Maintenance of meters; 26, Customers' repairs and renewals; 27, Maintenance of sub-stations; 28, To be reserved for future development.

General Expense.—29, Salaries of general officers; 30, Salaries of clerks; 31, Printing and stationery; 32, Store-room expenses; 33, Advertising, canvassing and soliciting; 34, Miscellaneous general expense and office sundries; 35, Legal expense and loss and damage; 36, Rents, 37, Insurance; 38, Taxes; 39, To be reserved for future development.

No. 1, Power Plant Wages.—To this account should be charged the wages of engineers, firemen, handlers of coal after it is unloaded, dynamo attendants, oilers, men wheeling and handling ashes, and watchmen. It covers wages for all kinds of work in the station that has to do with manufacture, as distinguished from repairs and increase to plant. When regular station men do small repairs, etc., it is not necessary to subdivide the wage charge, but where extra help is hired, or where employes work principally on repairs, the expense should be charged directly to the account benefited. Principal Items: Boiler cleaners, chief engineer, coal passers, dynamo attendants, engineers, firemen, oilers, other labor (boiler room), other labor (engine room), switchboard tenders, watchmen, water tenders.

No. 2, Fuel for Power.—To this account should be charged the cost of coal, wood, oil and gas used as fuel, and the cost of removal of ashes, including freight, hauling and cost of loading or unloading.

No. 3, Water for Power.—To this account should be charged water used in boilers, for condensing, etc. It does not include water power purchased.

No. 4, Lubricants and Waste for Power Plant.—To this account should be charged the cost of engine oil, dynamo oil, blower oil, cylinder oil, shaft grease, graphite, and waste or any other kind of wipers used in the station. It does not include oil for transformers, grease for wagons or oil for lanterns.

No. 5, Miscellaneous Supplies and Expenses for Power Plant.—To this account should be charged all expenditures for the operation of power plant not otherwise provided for. Principal Items: Boiler inspection, boiler compound, brooms, brushes for dynamos, brushes for scrubbing, buckets, chamois skins, dusters, emery cloth, fire buckets, fire extinguishers, flue brushes, hose, ice for ice water, light (lanterns and fixtures, oil, lamp wicks, torches, candles, incandescent lamps, arc-light globes and carbons), matches, mops, oil cans, packing, polish, sand paper, soap, sponges, sprinkling tools, tubs, waste cans, water-gauge glasses.

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*The subdivisions of light into incandescent and arc are not made general headings, because a great many companies connect both incandescent and arc lamps on the same meter, thus rendering such a separation of output and income impossible.

No. 6, Hired Power.—Charge to this account all expenditures for power purchased from other companies or power plants.

No. 7, Reserved for Future Development.

No. 8, Maintenance of Boilers.—To this account should be charged all repairs to boilers, foundations and settings, grates, stokers, smoke flues and iron stacks, damper regulators, safety valves, and gauge cocks.

(Where the stacks are of brick, repairs on these should be charged to maintenance of buildings and fixtures.) Principal Items: Boiler, boiler foundations, boiler appliances, boiler fittings, bolts, cement, damper regulators, fire brick, fire-clay, gauge cocks, grates, safety valves, smoke flues, stacks (iron), stokers (mechanical).

No 9, Maintenance of Engines.—To this account should be charged all repairs to engines, or replacements of parts worn out or destroyed. It covers also repairs on foundations and settings of engines. Principal Items: Engines, engine appliances, engine fixtures, engine foundations, engine parts.

No. 10, Maintenance Electric Plant.—To this account should be charged repairs to dynamos, armatures, fields, commutators, rheostats, switchboards and instruments, and all wiring in the station, including repairs to motors (except those driving cranes, pumps, etc.). Principal Items: Ammeters, armatures, boosters, cables, circuit breakers, commutators, dynamos, feeder terminals, fields, lightning arresters, rheostats, switchboards and instruments, switches, tools, transformers.

No. 11, Maintenance Miscellaneous Station Equipment.—To this account should be charged repairs and maintenance of condensers, pumps, injectors, heaters, economizers, hot wells, tanks, piping, pipe covering, separators, purifiers, drains, oil and grease cups, tools and instruments, coal and ash conveyors, belting, shafting, clutches, pulleys, scales, etc. Principal Items: Belt fixtures, belt tighteners, belts, clutches, coal and ash conveyors, coal conveying machinery, condensers, cranes, drains, economizers, heaters, hot wells, hoists, pipe covering, pipe fittings, piping, pumps, pulleys, purifiers, receivers, separators, sewer connections, shafting, tanks, tools and instruments, water connections, water meters.

No. 12, Maintenance Buildings and Fixtures.—To this account should be charged all kinds of repairs to the station or power-plant buildings or foundations of same, brick stacks, docks and wharves, elevators, traveling cranes, fences surrounding property, sidewalks and pavements adjoining the building, tool closets, toilet rooms, and all plumbing connected with the power or station buildings. This account refers only to power-station buildings. Principal Items: Awnings, bolts, bolt ends, brick, builders' hardware, building material, building permits, cement, cisterns, drains, excavations, fences, foundations, freight, grading, hauling, heating apparatus and fixtures, I-beams, iron, labor, lathes, lighting apparatus and fixtures, lime, lumber, nails, nuts, painting materials (oil, turpentine, varnish, lead, painters' supplies), paving in streets except in connection with tracks), plaster, drain pipes, gas pipes, sewer pipes, water, pipes, pits in car houses and shops, plumbing, rivets, roofing material, sand, sash cord, sash weights, platform scales, screws, sewering, shelving and other fixtures, shingles, sidewalks, slate, spikes, steel, stone, tools, tile, turn buckles, ventilating apparatus and fixtures, washers, water, water connections, water meters, wells, wire.

No. 13, Maintenance Dams, Canals and Tail-Races.—To this account should be charged repairs and maintenance of dams, canals, tail-races, etc., including filling in or repairing embankments, removing obstructions on ice, maintaining a boat to care for dam. Principal Items: Canals, dams, dredging out pond, intake pipe, sluice-ways, tail-races, tunnel, water racks, wheel house, wheel pit.

No. 14, Maintenance of Gates, Wheels and Governors.—To this account should be charged repairs and maintenance of head gates, penstocks, wheel gates, wheel governors, water wheels, and all connections with governors up to the line shaft. Principal Items: Gate lifting gear, head gates, penstocks, rope drive, rope drive (sheaves), rope drive (idlers), thrust bearings, turbine, turbine step, turbine case, water wheels, water wheel connections, wheel gate gear, wheel gates.

No. 15, Reserved for Future Development.

No. 16, Operating Arc Lamps.—To this account should be charged all wages and expenses of trimmers, patrolmen, inspectors' wages, inner and outer globes and carbons and cleaning of same, and the cost of all labor and sundries account of installing, removing or exchanging of arc lamps.

No. 17, Operating Meters.—To this account should be charged the expense of reading meters and the cost of all labor and sundries in regard to installing, removing, replacing or exchanging meters, together with the wages and expenses incidental to the inspection of same.

No. 18, Renewal of Incandescent Lamps.—To this account should be charged the cost of all first free installations and all renewals of incandescent lamps, together with testing and cleaning expenses in connection with same.

No. 19, Operating Sub-stations.—To this account should be charged the cost of all labor and material for the operating of storage battery, static or rotary transformer, or motor-generator sub-stations.

No. 20, Miscellaneous Distribution Operating Expenses.—To this account should be charged the cost of all new horses, wagons and harnesses to replace others worn out. It should also include the feed for horses, and shoeing, wages of stablemen, repairs to wagons, harness, automobiles, bicycles, etc., and all miscellaneous expenses not properly chargeable to accounts Nos. 14, 15 and 16; also the rentals of poles, lines or conduits may be properly a charge against this distribution operating account. Principal Items: Automobiles (repairs or replaced), bedding, bicyles (repairs or replaced), blankets, brooms, brushes, buckets, chamois skins, curry combs, dusters, feed, fire buckets, fire extinguishers, fuel, harnesses (repairs or replaced), wages of horse shoers, horse shoeing by contract, hose, wages of hostlers, ice, light, medicine, salt, sponges, sprinkling cans, wages of stablemen, veterinarian (salary or fees), wagons (repairs or replaced), water.

No. 21, Reserved for Future Development.

No. 22, Maintenance Underground System.—This account includes all cost for labor and material for maintaining and repairing all manholes, conduits, underground and submarine cables, both feeders and mains, together with services in connection with same. Principal Items: Bolts, cement, charcoal, conduits, underground feeders, insulators, iron, nuts, sand, screws, solder, soldering salts, steel, stone, submarine cables, switches, insulating tape, terminals, testing instruments, tools, washers, water, wire.

No. 23, Maintenance Overhead System.—To this account should be charged all labor and material for maintaining and repairing poles, cross arms, mast arms, arc suspensions, brackets, insulators, pins, wire and transformers, lightning arresters, fuses and other cut-outs outside of station. Principal Items: Arc suspension, bolts, boxes for lightning arresters, clamps for poles, iron cross arms, wood cross arms, overhead feeders, gasoline, hangers, hoods, overhead insulators, iron, mast arms, nuts, painting material for poles, iron pins for cross arms, wood pins for cross arms, iron poles, wood poles, pole tops for iron poles, screws, solder, soldering salts, steel, switches, insulating tape, testing instruments, tools, washers, wire.

No. 24, Maintenance Arc Lamps.—This account includes cost of all repairs and replacements, and repair parts in connection with same.

No. 25, Maintenance Meters.—To this account should be charged the cost of all repairs, renewals and replacements and all incidental expenses for the proper operation of the mechanical work in connection with the meter department.

No. 26, Customers' Repairs and Renewals.—Includes all repairs or small renewals or petty services or connection made on the premises of light and power customers for which the lighting company should bear the expense, either labor or material, such charges as are not properly chargeable to the customers, including free wiring of all descriptions, for the benefit of the customer, and all expenses from transformer or end of main line service to be charged against this account and not to investment.

No. 27, Maintenance of Sub-Stations.—Includes all repairs and small renewals made on sub-station building or apparatus, including batteries, rotaries, transformers, regulators, motor-generators, switchboard, etc.

No. 29, Salaries of General Officers.—Charge to this account salaries of president, vice-president, secretary, treasurer, auditor, general manager, assistant general manager, general superintendent, purchasing agent and all other officers whose jurisdiction extends over the entire system.

No. 30, Salaries of Clerks.—Charge to this account the salaries of bookkeepers, cashiers, collectors, paymasters, stenographers and clerks employed in the general office or elsewhere.

No. 31, Printing and Stationery.—Charge to this account all expenditures for printing, stationery and stationery supplies, except as hereinafter provided.

The cost of printing briefs and other legal papers should be charged to Account No. 35.

The cost of printing signs, posters and other advertising matter should be charged to Account No. 33.

Following is a list of some of the items chargeable to this account: Addressograph, arm rests, binders, blanks, blank books. blotters, blotting paper, carbon paper, copy (impression) books, copying brushes, dating stamps, envelopes, eyelets, eyelet punches, erasers, hektographs, indexes, ink, ink stands, ink erasers, letter presses, mechanical calculators, mimeograph, mucilage and brushes, numbering stamps, oil paper, paper (all kinds), paper baskets, paper clips, paper cutters, paper fasteners, paper files, paper weights, pencils, pencil erasers, pens, penholders, pen racks, pins, printing (except printing charged to accounts Nos. 27 and 28), rubber bands, rubber stamps, rulers, scrap books, sealing wax, seals, shears, shipping tags, shipping tickets, short. hand books, sponges, sponge cups, tissue (impression) paper, typewriters, typewriter supplies, twine, waste baskets, wrapping paper.

No. 32, Storeroom Expenses.—Charge to this account all salaries and expenses in connection with storeroom, including cost of sending material and supplies from general storeroom to branch storerooms, and the collecting of scrap material.

No.33, Advertising, Canvassing and Soliciting.—This account to include salary of contract agent and soliciting agents, together with all compensation for the procurement of central station business, including the cost of advertising of every description, including printing hand bills, dodgers, posters, folders, etc., the expense of distribution and displaying of same.

No. 34, Miscellaneous General Expense and Office Sundries.—Charge to this account the cost of office supplies, repairs and renewals of office furniture, wages of janitors, porters and messengers, the cost of public telephone service, maintaining and operating private telephone system, telegrams, subscriptions and donations, traveling expenses of general officers and others connected with general office, and contingent expenses connected with the general management not otherwise provided for.

The cost of printing, stationery and stationery supplies, should be charged to Account No. 31, except as otherwise provided.

Following is a list of some of the items chargeable to this account: Brooms, brushes, buckets, chamois skins, dusters, fuel, ice, internal revenue stamps, light, mops, newspapers, periodicals, postage, soap, sponges, sprinkling cans, towels, towel service, water.

No. 35, Legal Expenses and Loss and Damage.—Includes salaries and traveling expenses of attorneys, and fees, court costs, whatever the cause may be, and all expenditures on account of property damaged and persons killed or injured; salaries and expenses of claim agents, investigators, adjusters, and others engaged in the investigation of accidents and adjustment of claims; salaries, fees and expenses of surgeons and doctors, nursing, hospital attendance, medical and surgical supplies, fees and expenses of coroners and undertakers, fees of witnesses, and others.

Following is a list of some of the items chargeable to this account: Attorneys' fees and expenses, coroners' fees and expenses, damage claims for electrolysis, damage claims for horses injured or killed, damage claims for persons injured or killed, damage claims for property damaged, damage claims for wagons or vehicles damaged, doctors' expenses, doctors' fees or salaries, funeral expenses, hospital expenses, investigators' expenses, investigators' salaries, medical supplies, nurses' expenses, nurses' fees, surgeons' expenses, surgeons' fees, surgeons' salaries, surgical supplies, undertakers' expenses, witnesses' expenses, witnesses' fees, court costs.

No. 36, Rents and Maintenance of Offices.—To this account should be charged all rent paid for land and buildings used in the operation of the company, and operation and maintenance expense of separate office buildings or company's offices.

No. 37, Insurance.—To this account should be charged the cost of insuring the property against fire, all accident insurance and steam boiler or employers' liability insurance.

No. 38, Taxes.—Includes all taxes on personal property or real estate.

It is practically universally conceded by the latest authorities that taxes should be considered as a separate expense account under the heading of general expense and not as a fixed charge.

A fixed charge is properly a guaranteed return on invested capital, being specifically represented (first) by interest on mortgage bonds, and (second) by guaranteed interest return on any other class of interest-bearing securities, said interest return always being in the nature of a fixed or guaranteed percentage, such as interest on debentures or interest on certain classes of preferred stock.

In conclusion, a fixed charge is any guaranteed interest return on securities issued, which interest must be paid and deducted from net earnings, thereby leaving net profits, out of which net profits regular stock dividends can be paid.

Chance for Navy Yard Positions.

An examination of applicants will be held at the Navy Yard, New York, August 7, or as soon thereafter as practicable, for filling the following positions:

Office of the U. S. Inspector of Equipment, Crescent Shipyard, Elizabeth, N. J.; one first-class assistant electrical draftsman, $4 per diem.

The examination will be open to all comers, who can give evidence of experience in the kind of work for which they seek employment, and who are citizens of the United States. Persons now holding positions at the yard will be admitted to competition on the same footing as other applicants.

Applications will be addressed to the "Commandant, Navy Yard, New York," and must be delivered to him on or before Tuesday, August 6. No application received after that date will be considered.

Each applicant will state in his application his name, age, residence, citizenship, present occupation, and previous employment or work done.

The applications will be accompanied by evidence of citizenship, and by certificates, preferably from previous employers, as to character, habits of industry and sobriety, and skill and experience in work of the kind required.

Electric Company Wins Suit.

The arbitrators in the case of the Langhorne, Pa., Electric Light and Power Company against the Newtown and Bristol Street Railway Company, have awarded the plaintiff $5,952.35 and costs. The arbitrators were Charles F. Hall, Mahlon H. Stout and J. Ferdinand Long, of Doylestown, Pa. The suit arose over an alleged violation of contract between the plaintiff and defendant companies. An agreement was entered whereby the plaintiff was to furnish power for the operation of the defendant's railway. It was averred by the Electric Company that after going to considerable expense to increase the capacity of its plant that it might conform to the terms of the contract, the agreement had in part been repudiated by the defendant to the pecuniary loss and disadvantage of the plaintiff for which it sought to recover.

The French Engineers' Coming Visit.

The party of French electrical engineers will arrive in New York on Sunday, August 11, and leave the same evening for Philadelphia. On Monday the places of interest in that city will be visited and the same evening a train will be taken for Washington. Leaving the latter city on Wednesday afternoon the party will return to New York, where technical visits will be made on Wednesday, Thursday, Friday and Saturday. Monday, a visit to the works of the General Electric Company and departure for Buffalo in the afternoon by special train. From Tuesday to Sunday attendance at the Convention of the American Institute of Electrical Engineers, visits to the Pan-American Exposition and an excursion to Niagara Falls. On Sunday, August 25, the party will start for Chicago, where it will remain until Tuesday night, leaving then for Kingston, Canada. Passing the night at Kingston a boat will be taken for the Thousand Islands in the St. Lawrence River. The party will then proceed to Montreal, where it will remain Friday and Saturday. On the evening of the latter day a steamer will be taken for Quebec; in that city Sunday and part of Monday will be spent, leaving Monday afternoon. From Quebec the party will go to Plattsburg by boat down the Champlain, arriving in New York on Wednesday, September 4, and sailing next day for France.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended July 25:

Amsterdam, 1 motor vehicle, $850; 2 cases, $40; Antwerp, 230 packages, $8,236; Argentine Republic, 1 package, $67; 3 cases, $557; Brazil, 61 packages, $2,140; Bremen, 1 package, $10; British East Indies, 209 cases, $5,464; British Possessions in Africa, 1 package, $25; British West Indies, 38 packages, $2,031; 1 case, $729; Central America, 11 cases, $310; Cologne, 6 packages, $400; Cuba, 9 cases, $1,265; 211 packages, $9,293; Danish West Indies, 1 package, $10; Dutch West Indies, 4 packages, $70; Ecuador, 53 packages, $1,140; Glasgow, 19 packages, $2,900; Hamburg, 32 packages, $1,644; Havre, 20 packages, $1,250; 6 cases, $231; Liverpool, 76 cases, $5,044; 2 cases motor vehicles, $1,800; London, 317 cases, $13,543; Manchester, 17 cases, $1,643; Mexico, 11 packages, $2,408; Newcastle, 43 cases, $5,250; Peru, 80 cases, $7,013; Rotterdam, 1 case, $100; Santander, 1 case, $6; St. Petersburg, 2 packages, $132; Southampton, 98 cases, $14,742; U. S. Colombia, 4 cases, $245; Venezuela, 42 cases, $1,078; Walsall, 11 packages, $520.

CANADIAN NOTES.

(From our Ottawa Correspondent.)

It is said that the town of Levis, Que., is about to have an electric street railway and that it is proposed to extend the system to other municipalities of Levis County. With this view Mr. P. Lane, of the American Bridge Company; Hon. C. C. Colby, of Stanstead; Mr. E. C. Crosby, of Brattleboro, Vt., and others, have lately been over the ground.

A cablegram has been received by Mr. L. Trudeau, of the Montreal Electric Street Railway, from Mr. Duncan McDonald, manager of the Paris street railway system and formerly of Montreal, offering Mr. Trudeau the position of superintendent of tramways at Bordeaux. Mr. McDonald revolutionized the car service in Paris, bringing it up from a ten-minute to a two-minute service.

Mr. John Murphy, of the Ottawa Electric Company, has just received a most useful souvenir of the recent Electric Convention at Niagara Falls. It is an incandescent lamp, which can be used as one candle power or sixteen candle power. The lamp is the same size as the ordinary incandescent lamp, but it is provided with two filaments and either of them may be used by simply giving the lamp a slight turn in the holder. The advantage of an incandescent light, which can be turned down, is apparent to everybody. This "Hylo" lamp is much admired in Ottawa, and the Ottawa Electric Company is taking immediate steps to procure a stock of them for the benefit of its customers.

The Canadian Society of Civil Engineers will hold its summer meeting in Buffalo, on the 26th, 27th and 28th of September next. For some time past the secretary, Mr. C. H. McLeod, has been making the necessary arrangements so that the members of the society may have as much time as possible taking in the sights of the exposition. The Engineers' Society of Western New York has placed its rooms at the disposal of the visitors. A special committee of the members of the same society, of which Mr. Geo. A. Ricker is chairman, will assist the members of the Canadian Society in viewing works of engineering interest in or near Buffalo.

PERSONAL MENTION.

Mr. B. G. Hubbell has recently been elected president of the Consolidated Telephone, Telegraph & Cable Company of America and of the Interocean Telephone & Telegraph Company.

Mr. H. F. De Cew has been appointed superintendent of the Penn Yan, Keuka Park & Branchport (N. Y.) Electric road.

Mr. L. D. Beylard is now in charge of the Philadelphia office of the National Conduit & Cable Company.

Mr. Maxime Reber, it is said, will succeed Judge Thomas as manager of the United States Telephone Company of Cleveland.

The Catskill Mountains.

Looking benignly down upon the valley of the Hudson and watching that historical stream from the top of the Catskills, one imagines it to be a silver thread woven into the green and brown which form the hills and valley of the Hudson. This famous region is only three hours from New York by the West Shore and its connections on the west side of the river, and only three hours from New York by the New York Central on the east side of the river. Both roads serve it and the boats on the Hudson carry to and from this delightful region their share of the ever increasing traffic.

COMING ELECTRICAL EVENTS

American Institute of Electrical Engineers—General Meeting, Buffalo, N. Y., August 20-24.

American Street Railway Association—Convention, New York City, October 9, 10 and 11.

American Electro-Therapeutic Association—Buffalo, N. Y., September 24, 25 and 26.

Association of the Edison Illuminating Companies—Meeting, September 10.

International Association of Municipal Electricians—Convention, Niagara Falls, September 2, 3 and 4.

Ohio Electric Light Association—Convention, Put-in-Bay, August 20, 21 and 22.

Old-Time Telegraphers' Association and U. S. Military Telegraph Corps—Convention, Montreal, September 11, 12 and 13.

Pennsylvania State Street Railway Association—Convention, York, Pa., September 4.

Roentgen Society of the United States—Meeting, Buffalo, N. Y., September 10 and 11.

INCORPORATIONS.

The Wenatchee Electric Light & Power Company, Wenatchee, Wash. Capital stock, $6,000.

The West End Electric Park Company, Richmond, Va. Capital stock, $25,000. Officers: President, Andrew Pizzini, Jr.; vice-president, Harvey L. Wilson.

The Ackeman Compress Warehouse & Electric Light Company, Jackson, Miss. Capital stock, $25,000. Incorporators: J. E. Cobb, A. C. Ramar, Blumfield & Fried, W. A. Hanna & Co., Russel Davis, Irving & Baine and W. R. Irving.

The Waverly Electric Light Company of Humphreys County, Waverly, Tenn. Capital stock, $5,000. Incorporators: Arthur E. Justice, B. R. Thomas, J. P. Cowden, J. F. Fowlkes, W. N. McCreary, H. H. Harris and J. C. Harris.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 23, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

678,894. Trolley Signal. Charles H. Morse, Cambridge, Mass. Filed Aug. 11, 1900.

678,974-678,975. Car-Fender. Richard F. Preusser, Washington, D. C. Filed March 28, 1901, May 10, 1901.

679,220. Trolley. Napoleon Durant, North Adams, Mass., assignor of one half to Jerome L. Cross, Adams, Mass. Filed Aug. 18, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

678,873-678,876-678,951-678,952. Electric Arc Lamp. John A. Heany, Philadelphia, Pa., assignor to the Teter-Heany Developing Company, same place and Charleston, W. Va. Filed Nov. 14, 1900, Jan. 28, 1901, Dec. 13, 1900, April 30, 1901.

678,916. Electric-Arc Lamp. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company of New York. Filed Dec. 26, 1899.

678,991. Circuit-Breaker. Henry P. Ball, New York City, assignor to the General Incandescent Arc Light Company, same place. Filed July 7, 1900.

679,206. Locking-Socket for Incandescent Electric Lamps. Charles R. Barrett and Elwood C. Phillips, Chicago, Ill. Filed May 13, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

678,853. Motor Control System. Albert H. Armstrong, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 8, 1901.

678,854. Control of Induction-Motors. Albert H. Armstrong, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed May 9, 1901.

678,861. System of Motor Control. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Feb. 15, 1901.

678,874-678,875. Electric Motor. John A. Heany, Philadelphia, Pa., assignor to the Teter-Heany Developing Company, same place and Charleston, W. Va. Filed Nov. 19, 1900.

678,904. Dynamo Electric Machine. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 25, 1900.

678,914-678,989. Controller for Electric Motors. Emmett W. Stull, Johnstown, Pa., assignor to the Lorain Steel Company of Pennsylvania. Filed Jan. 14, 1901, Sept. 28 1900.

678,964. Commutator for Dynamo-Electric Machines. Frank A. Merrick, Johnstown, Pa., assignor to the Lorain Steel Company of Pennsylvania. Filed Nov. 14, 1900.

679,041. Electrical Sparking Device for Explosive-Engines. Richard Varley, Jr., Jersey City, N. J. Filed Oct. 5, 1900.

679,243. Sparking Igniter for Explosive-Engines. Schiller A. Rhode and Jacob Dubord, Manitowoc, Wis. Filed Aug. 9, 1900.

679,284. Armature Winding. Wilhelm Lau, Berlin, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed March 19, 1900. Renewed June 27, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

678,972. Telephone-Transmitter. James G. Nolen, Chicago, Ill. Filed April 11, 1901.

679,029. Calling Device for Telephone Exchanges. Frank A. Lundquist, Chicago, Ill., assignor to M. E. Richardson, trustee, Sterling, Kan. Filed May 27, 1899.

679,068. Apparatus for Telephone-Lines. Albert M. Bullard, Chicago, Ill., assignor to the Western Electric Company, same place. Filed June 7, 1899.

MISCELLANEOUS.

678,851. Apparatus for Electrolysis of the Salts of Alkali Metals. Henry S. Anderson, Springfield, Mass. Filed Nov. 28, 1899.

678,871. Device for Recording Meter Readings. Caryl D. Haskins, Newton, Mass., assignor to the General Electric Company of New York. Filed Feb. 11, 1899.

678,878 Locating Grounds on Electric Circuits. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 14, 1900.

678,880 Conduit-Plow. Joseph Hoffman, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 12, 1900.

678,881. Circuit Breaker, Charles E. Holmes, Lynn, Mass., assignor to the General Electric Company of New York. Filed March 31, 1900.

678,887. Resistance Device. Carl W. Larson, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 18, 1900.

678,905. Controlling High-Potential Circuits. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company of New York. Filed May 24, 1900.

678,929. Electric Meter. John H. Barker and James A. Ewing, Cambridge, Eng. Filed April 6, 1901.

678,953. Electric Clock. George Hookham, Birmingham, Eng. Filed Dec. 15, 1900.

678,957. Electrical Instrument. John F. Kelly, Pittsfield, Mass., assignor of one-half to Cummings C. Chesney, same place. Filed April 23, 1901.

678,998. System of Electrical Distribution. Harry E. Heath, Windsor, Conn., assignor to the Eddy Electric Manufacturing Company, same place. Filed May 15, 1901.

679,004. Automatic Electric Stop for Elevators. Henry B. Newhall, Jr., Plainfield, N. J., assignor to Henry B. Newhall, Sr., same place. Filed Oct. 31, 1900.

679,006. System of Electrical Distribution. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Dec. 12, 1899.

679,008-679,092. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Company of New York. Filed Dec. 9, 1899, Jan. 2, 1901. Renewed Aug. 22, 1900.

679,050. Liquid-Feed Device for Electrolytic Apparatus. Raoul Girouard, Westbrook, Me., assignor to S. D. Warren & Company, Boston, Mass. Filed May 11, 1899.

679,057. Junction-Box and Adapter for Electrical Installation. John Meehan, Brooklyn, N. Y. Filed May 16, 1901.

679,097. Reversing Mechanism for Motor-Vehicles. William Van Wagoner, Syracuse, N. Y., assignor to the Century Motor Company, same place. Filed April 26, 1901.

679,102. System of Electrical Distribution. Ernst J. Berg, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 2, 1901.

679,138. Electric Metering System. Louis Bell, Newton Center, Mass., assignor to the General Electric Company of New York. Filed March 26, 1900.

679,151. Combined Switch and Circuit-Breaker. Thomas J. Johnston, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Feb. 16, 1899.

679,197. Electrically-Operated Gas-Burner. Holstein W. Webb, Columbus, O. Filed April 27, 1901.

679,258. Process of Obtaining Volatile Elements from Their Compounds. Alfred H. Cowles, Cleveland, O., assignor to the Electric Smelting and Aluminum Company, same place. Filed July 19, 1900.

DESIGNS.

24,821. Vaporizer for Incandescent Lamps. Edward C. Smith, Canton, O. Filed June 15, 1901. Term of patent 7 years.

34,848-34,849. Electric-Light Sign. Mortimer Norden, New York City, assignor to himself and John Bittner, same place. Filed June 28, 1901. Term of patent 14 years.

REISSUE.

11,922. Telephone-Circuits. Percival G. Burgess, Mexico, Mexico, and Henry W. Wilder, Albany, N. Y., assignors to the American Bell Telephone Company, Boston, Mass. Filed April 19, 1901. Original No. 626,826, dated June 13, 1899.

THE TELEPHONE WORLD.

Independent Telephone Association of Texas

A meeting of representatives of what are known as the independent telephone companies of Texas, the Indian Territory and Oklahoma was held at Ft. Worth a short time ago.

The meeting was called to order by J. E. Boynton of Waco.

E. D. Mims of the Arkansas Valley Company was chosen temporary chairman, and O. C. Obetz of Corsicana was made secretary. Both were made permanent officers.

A committee on constitution and by-laws was appointed as follows: J. B Earle, G. R. Roberts and G. T. Curtis. This committee reported to the effect that the name of the organization will be the Texas, Oklahoma and Indian Territory Independent Telephone Association, and its purpose is for members to co-operate in the maintenance of an independent telephone system in the sections referred to.

Officers were elected as follows: J. E. Boynton, president; C. W. Roberts, first vice-president; E. D. Mims, second vice-president; C. H. Duffy, third vice president; J. B. Earle, secretary and treasurer: executive committee, H. M Aubrey, W. T. Hutchins and John M Noble.

Talks were given by several members. Mr. J S. Brailey spoke on construction, saying that it would take several million dollars to properly construct the desired independent lines in Texas.

H. W. Pope, general manager of the Bell Telephone Company of Rochester, N. Y., has inaugurated a feature new to the telephone business, which undoubtedly will be generally adopted by the telephone companies, notwithstanding the considerable expense it involves. Hereafter the number of subscribers' stations and the names of subscribers will be published at intervals in the daily papers as the stations are installed. This will obviate the necessary delay arising in the publication of the telephone directories, which occupy generally a whole month in their compilation, publication and delivery. The directory is reaching enormous proportions and some way had to be devised to overcome the delay in the publication of the subscribers' names. Several hundred stations have been installed in Rochester since the addendum of April 1, and these names will now be published in lots of fifty until the names are brought up to date, after which they will be published in lots of about the same number, or according to the rapidity in which they are installed. Subscribers clipping the lists from the daily papers as they appear will at all times have the names complete and up to date.

The Standard Telephone Company is rapidly pushing the extension of its line to Quakertown, Pa. At Trumbauersville the Standard line will connect with the Inter-State line, which will secure direct connection with various points in the Lehigh Valley and other parts of the State. At Perkasie 18 subscribers have been secured, 3 at Silverdale and 2 at Dublin. An ordinance was passed by the Silverdale council for the erection of poles in that borough. As soon as the workmen get the line at work at Quakertown they will proceed to Dublin, and from that place continue the wires to Doylestown via Silverdale and Dublin. The company expects to have the connection between Doylestown and Colmar in working order before the first of September. This will give direct connection with the Keystone Telephone, which will build to that point.

The Northwestern Ill., Telephone Company, with a capital stock of $500,000, operating telephone exchanges in Aurora, Joliet, Plainfield, Elgin, Dundee, Batavia Geneva, St. Charles, Sugar Grove and Kaneville and all farming towns of Kane County, at a recent meeting of stockholders and directors elected Senator H. H. Evans of Aurora, president.

The People's Telephone Company of Knoxville, Tenn., will extend its toll lines from Clinton to Jellico and to Harriman in the fall. General Manager J. C. Duncan says this work will not begin until the improvements now being made in Knoxville have been completed.

The board of mayor and aldermen has granted a privilege to the Jackson, Tenn., Home Telephone Company to establish and operate the Kellogg system of telephones in Jackson. Preparations will be begun at once to put the new system into operation.

The Black River Telephone Company has completed the stringing of its wires to the village of Holland Patent, N. Y., where connections are made with the Rome Home telephone line.

From recent news from Fort Smith, Ark., the Pan 'phone project is an assured success, and there is now no doubt but that the Pan plant will in a short time lead the Bell in every particular.

The Seattle Telephone Company's New Plant.

The Seattle, Wash., Automatic Telephone Company is prosecuting the work of installing its new plant with great energy. It has ordered wire and cables to the extent of $160,000, and has 15 carloads of iron material on the way. At a cost of $125,000 large switchboards are being made, with an ultimate capacity of 12,000 'phones.

With regard to conduits, orders have been placed for between 250,000 and 300 000 linear feet, and the first shipment will be there in thirty days. When this arrives the company will begin its installation with a force of 300 men, in addition to the 100 already engaged in aerial construction.

The company is using about 1,200 telephone poles each month. In the business district the policy adopted in all large cities will be followed as regards the method of distribution. A single pole, 70 feet in height, will be erected in the middle of the alley in each block. All the conduits will lead to the foot of this pole, and wires will radiate from the top to all the buildings in that block.

The plans and specifications are about to be adopted for the new two story and basement office building of the company. The structure will be of stone, and the company will move in as soon as the building is completed and the switchboards ready for use.

The total number of 'phones now being operated by the Automatic Company is over 400, being 100 in excess of the franchise requirement. The officials state that not a single complaint has yet been made regarding the service given.

A report from Everett, Wash., states that in a short time the North Coast Electric Company will have its messenger service in thorough working order, and then expects to have 100 call boxes in Everett. Instead of the automatic call boxes in general use the North Coast Electric Company has a small telephone which rings up the main office automatically when the receiver is taken down. The office is connected with fire and police departments and livery, and the telephone system's superiority over the old method is obvious The management expects to keep in touch with police officers on their beats during the night. In Tacoma the company keeps the night tally sheet for the chief of police and each officer reports at the end of his beat. As a consequence it will be possible to talk to an officer almost at any hour of the night and direct him to answer a "hurry up" call.

If the Chicago Telephone Company fails to heed the opinion of Corporation Counsel Walker, that it cannot charge $175 a year for its "improved service," several business men threaten to at once begin mandamus proceedings to compel the company to adjust its rates to the maximum figures specified in its franchise ordinance - $125 a year for business, and $100 for residence telephones. The company as yet has taken no steps to alter its rates, and President Sabin has intimated that no such action will be taken until the courts so command.

E. A. Fuller, of Ludington, Mich, has organized a telephone company which has purchased of the Oceana Telephone Company, all its lines, telephones, rights, etc, in that country. The purchase also includes the line to Walkerville and the ones recently begun to Manistee and Baldwin. These will be completed and further connections with neighboring towns made. The Oceana Company was formed some years ago as a joint stock company, but owing to the spirited opposition of the Bell Company never met with much success.

President Wallace and other officials of the Rocky Mountain Bell Telephone Company were in Douglas, Wyo, recently, and stated that the long distance telephone line from Cheyenne to Douglas will be completed and in operation by October 1. Work will shortly be commenced on both ends of the line and rushed to completion. Local feeders will be built at once and the line extended to Casper. Next year the wire will be extended to Lander.

A telephone line is being constructed between Carrollton and Brookfield, Mo.

The Citizens' Telephone Company at Laconia, N. H., is extending its lines to Ladd Hill, Belmont.

A severe thunder storm recently damaged the telephones in Huntsville, Ala.

The telephone line from Valley City to Fingal, N. D., will be in operation next month.

The Faulkton, S. D., telephone exchange has been sold to Fremont Young and J. H. Hays of that place.

Bankers' Telephone Exchange.

The proposed new exchange for bankers, brokers and trust companies about to be inaugurated by the New England Telephone & Telegraph Company is a new departure in telephone service, says the Boston, Mass., "Journal." It is a project that the management of the company has had in mind for some time past, but has only recently brought out. Solicitation for subscribers during a period of two or three days brought favorable responses from over 30 houses, and it is believed that this number will be increased to 50 or 75 without difficulty.

The new service will be a special wire private telephone service, with the headquarters at some one of the company's central offices, and will cost the bankers, brokers and trust companies $72 per annum. The purpose of the service is to provide for business done exclusively between these interests, and will meet a want that has long been felt. It will in no wise interfere nor be a part of the regular telephone service already established.

News from Bozeman, Mont., states that work has commenced on the Pass Creek telephone line. The poles were laid along the route of 30 miles. Each farmer along the line will have to set the posts from the main line to his house, and also string the wire and make the connection. It is very likely the Pass Creek telephone will be in good working order September 1. The total cost of the line from Bozeman to Pass Creek including the branches to farm houses and little hamlets along the line will be in the neighborhood of $1,500 Each farmer buys his own telephone, which costs him $50, and helps in the construction as much as possible.

A B Ferdinand, president of the Northwestern Telephone & Electric Company, and of the Sheboygan County Telephone Company, has asked the board of public works for a permit to construct a telephone line into St. Paul, Minn. There seems to be no question but that a permit will be granted, as the members of the board of public works who have read the Supreme Court decision are of the opinion that it cannot be refused.

Newport, R. I., has lately been struggling with poor telephone service, but something better is promised, and the difficulty is not one that the company can well be blamed for. During the past spring there has been a material increase in the number of subscribers, and there are more than 830 now on the board.

The Sebree, Ky., Independent Telephone Company has connected its exchange with the Henderson Independent exchange. The new line is via Corydon and Poole, and the line into Dixon is nearing completion. The company proposes to connect with every independent line east of the Green River, including Louisville and other large towns.

The control of the independent telephone organization at Gowanda, N. Y., has been acquired by E. C. Fisher, of Gowanda, and will hereafter be operated under a license from the New York and Pennsylvania Telephone & Telegraph Company, a Bell concern.

The Southwestern Telegraph & Telephone Company is now putting up wires from Rockdale through Tanglewood to Lexington, Tex., and in a few days will have communication with the outside world. The wires will be extended down the Sap Road in a short time.

A telephone line has been completed from Yazoo City to Eden, Beelake, Thornton and Nileston, Miss., and connection made with the Mutual Telephone Company at Yazoo City.

The Nebraska Telephone Company has a force of men at Cresco, constructing a line from Wahoo to that village, and in a few days Cresco will be in touch by 'phone with the outside world.

News from Natchez, Miss, states that telephone connection with St Joseph, La., was completed a short time ago. The St. Joseph exchange opens with 62 subscribers and L. T. Moore, of Natchez, as manager.

TELEPHONE INCORPORATIONS.

The Perry Telephone Company, New Lexington, O. Capital stock, $25,000.

The Southwest Missouri Telephone Company, Aurora, Mo. Capital stock, $50,000. Incorporators: George R. Armstrong, Richard T. Brite and R. H. Davis.

The Telephone Printing Company, New York City. Capital stock, $10,000. Directors: R. A. Saalfield, E. H. Rosenblatt and F. A. Thomson, all of New York City.

GENERAL ELECTRICAL NEWS.

Lighting.

Abbotsford, Wis.—The Abbotsford Electric Light & Power Company is the name of a new company recently organized.

Belmont, Wis.—J. F. Fisher is asking for a franchise to install an electric lighting plant at this place.

Bristol, Tenn.—The Bristol Light & Power Company, recently organized, has inaugurated a new system of incandescent lighting here.

Brookings, S. D.- Sealed proposals for the construction of a waterworks system and the extension of the electric lighting system will be received by the common council until 3 o'clock, August 7. J. V. Walker, city clerk.

Brownwood, Tex.—B. S. Boysen of this place wants to purchase a 40 kilowatt direct current, and a 60 kilowatt alternating current electric plant.

Chester, Pa.--The Beacon Electric Light Company is enlarging its facilities to supply all the demands upon it, and will give a much better service generally.

Curwensville, Pa.—Charles L. Frank of this place, an electrician, has been awarded the contract of putting in the electric appliances and necessary machinery for light and other work in the Fulton tunnel and Shawsville tunnel, now in progress of excavation on the new West Branch Valley Railroad.

Evansville, Wis.—At a recent public meeting held to discuss the waterworks and electric light question the Baker Manufacturing Company offered to put in and equip the system and furnish the power from its own plant.

Farmville, Va.—The Virginia Normal State School of this city is to have an electric light plant, which will be completed and ready for use by the opening of the school in September.

Georgetown, Tex.—This town will hold an election to vote on a municipal electric light plant. Address the mayor.

Grantsburg, Wis.- A special election held at this place, voting on a franchise to the Grantsburg Electric Light & Power Company, carried the measure by a large majority. An electric light plant will be put in at once.

Madison, Wis.—The Northern Electric Company will soon build an addition to its plant here, which will cost not less than $100,000.

Meridian, Miss.—Marks, Ruthenberg & Co. will erect an electric plant for lighting the five-story opera house block and other buildings.

Oneida, Ill. –This town is to have an electric light plant. A stock company has been formed and work on the building for the plant will be commenced at once.

Orville, O. - The citizens will vote on August 5 on the question of bonding the village in the sum of $15,000 for the purpose of installing an electric light plant.

Oshkosh, Wis.--The Oshkosh Electric Light & Power Company will shortly be reorganized and $[illegible]0,000 spent in rebuilding the plant.

Park River, N. D.—This city will receive bids for the construction of an electric light plant and a system of waterworks. O. F. Lofthus, city auditor, can be addressed.

Pittsburg, Pa.—Attorney George W. Herritott will apply for a charter for the Edgewood Light, Heat & Power Company. The new company will supply Wilkins and Sterrett townships and the boroughs of North Braddock and Rankin.

Sharon, Tenn.—The citizens are making a strong effort to put in an electric light plant in connection with their waterworks which have just been completed.

Stockbridge, Mich.—Stockbridge has been granted a lighting franchise by which either gas or electricity may be used.

Sturgeon Bay, Wis.—The city council has granted a franchise to W. H. Wheeler for the erection of a waterworks and electric light and heating system.

Tryon, N. C.—This town will issue $25,000 of bonds for the construction of a waterworks system, electric light and street improvements. Address P. H. McDonald.

Street Railways.

Batavia, N. Y.—The long-expected franchise for the Ridge Road trolley line was lately granted by the State Railroad Commissioners, and it is said that work will be commenced at once and pushed as fast as possible.

Bloomington, Ill.—The Northern Illinois Electric Railway Company has been incorporated with a capital stock of $700,000. The road will be constructed in Lee County from Steward through Dixon and Amber to Lee Center.

Bridgeport, O.—Fire recently destroyed the Wheeling Traction Company's barns and power house, together with 20 cars, entailing a loss of $50,000.

Donaldsonville, La.—It is proposed by a number of well-known men to build an electric road from Houma to this place by way of Thibodeaux.

Flushing, N. Y.--The steam railroad, built between here and Garden City in 1872 by A. T. Stewart, is to be rebuilt and operated by electricity, according to a statement made by Henry C. Rath, a real estate dealer in this place.

Galveston, Tex.—The Galveston Street Railway Company will begin at once on the erection of its proposed $175,000 power house. W. A. Haller, of Sanderson & Porter, electrical engineers of New York, is interested.

Indianapolis, Ind.—The Eastern Indiana Traction Company, which will construct a line from Richmond to Portland, a distance of 50 miles, has been incorporated with a capital stock of $10,000. Peter Schwab, of Hamilton, O., is president of the company.

Langhorne, Pa.- Surveyor Charles H. Moon, of Woodbourne, has been engaged by the Philadelphia & Langhorne Street Railway Company to survey for a trolley line to connect this place and Summerton.

Louisville, Ky.--The Louisville, Anchorage & Pewee Valley Eectric Railway Company has completed arrangements with Eastern and Western capitalists to issue $18,000,000 of 40-year 5 per cent. gold bonds. The purpose is to cover a great part of Kentucky with a system of interurban electric railways The line running from Louisville to Pewee Valley is the trunk from which branches will be run all through the Blue Grass section of the State, extending as far as Stanford and Richmond.

Muncie, Ind.—The capitalists backing the proposed electric line between Muncie, Middletown and Greenfield have reported to E. T. Ice that they are entirely satisfied with the territory, and will furnish the necessary capital to build the road as soon as the right-of-way is secured.

New Orleans, La.—The promoters of the electric railroad between this city and Lake Pontchartrain organized a company with $350,000 capital stock to promote the enterprise. Among those interested are A. H. Prentzel, who is president of the company, and George S. Kausler, vice president.

Oneida, N. Y.—The Oneida Street Railway, together with cars and equipment, were lately purchased by the Cleveland, O., syndicate, which has recently purchased all of the trolley lines in this vicinity. The syndicate was represented by Horace E. Andrews, of Cleveland.

Paterson, N. J.—Arrangements are being made to extend the trolley service from this city to North Paterson.

Port Byron, N. Y.—Samuel Nichols of Palmyra, a representative of the Sodus Electric Railroad, has been here securing permits to run an electric road through this place.

Reading, Pa.—The United Traction Company of this city has secured an option for the purchase of the Reading & South Western Railway and it is stated that the deal will be closed on August 1, thus giving all of the trolley lines in the city over to the control of one company.

Richmond, Va.—The Westhampton Park Railway Company, which is constructing an electric line in the suburbs of this city, has given a mortgage to the Richmond Trust & Safe Deposit Company amounting to $200,000.

Manufacturing.

Lafayette, Ind.—It is stated that the patent trolley wheel, which has been tried on the street cars of Terre Haute, will be manufactured in this city. The company asks for a sufficiently large tract of land to erect a $5,000 plant that will contain about 7,000 feet of floor space.

Milwaukee, Wis.—The Reliance Electric Company, which will manufacture all kinds of electric machinery, was organized a short time ago in the office of W. J. McElroy with a capitalization of $30,000. The officers are: Thomas Croil, president; W. J. McElroy, vice-president; F. J. Kipp, treasurer; H. B. Dewey, secretary; Thomas Croil, F. J. Kipp, H. B. Dewey, W. J. McElroy and F. T. Chapman are the directors.

New York City.—The Willis Manufacturers' Agency has been formed to purchase and sell electrical batteries on a capital of $50,000.

Philadelphia, Pa.—The Sun Electric Manufacturing Company continues to have plenty of orders and is kept busier than the capacity of the plant can meet.

Rochester, N. Y.--The Pullman Railroad Supply Company will manufacture and sell trolley catchers, electrical supplies and railroad appliances. It is capitalized at $20,000.

Solvay, N. Y.—Messrs. Pass & Seymour have organized a company for the purpose of manufacturing electrical appliances with a capital stock of $100,000. Among the interested parties are James Pass, A. P. Seymour and B. E. Salisbury of Syracuse.

Company Matters.

Cleveland, Tenn.—The Cleveland Electric Light Company is getting ready to build a new power house.

Trenton, N. J.—The Lackawanna & Wyoming Valley Rapid Transit Company, which was incorporated about a year ago, has filed papers increasing its capital stock from $5,000,000 to $6,500,000. The company was incorporated to construct and operate railroads.

Washington, Pa.—A meeting of the directors of the Manufacturers' Light & Heat Company will be held September 10, to consider an increase of the capital stock from the present figure, $1,500,000 to $5,000,000.

Power and Transmission.

Chattanooga, Tenn.—The talk of utilizing the power of the "Suck" for the purpose of developing electrical energy to be used in manufacturing in this city has brought to light other schemes having the same end in view, that is furnishing electrical power to manufacturers and others. One is to utilize the vast coal measures now undeveloped in Walden's ridge, placed under the boilers right from the coal chute, thus saving the cost of transportation to the city.

Trenton, N. J.—The Gould's Rifts Power Company has been incorporated in this city. The company proposes to build a dam across the Delaware River, near the island owned by the Park Island Canoe Club, and by it generate power and electricity. The scheme has been agitated on numerous occasions, but never has there been a company formed with a view to carrying forward the scheme. The incorporators are E. C. Hill, Harry Hill and Thomas C. Hill. The capital stock of the company is $100,000.

Worcester, Mass.—The Power Manufacturing Company of this city has been incorporated under the laws of Massachusetts to own and operate the big power station at Sutton Lane, which supplies the power for the greater part of the Consolidated Street Railway system. The capital stock of the new corporation is $650,000.

Automobiles.

Dover, Del.--The Washington Auto Vehicle Company of Washington, D. C., was chartered July 25 to make, sell and lease motor vehicles with a capital of $1,000,000.

Union, O.—The Union Automobile Company was incorporated recently with a capital stock of $50,000.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by Electricity from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Albany, N. Y.–July 29						
United Traction (Consolidation of the Albany and Troy City Railway.)	100	$5,000,000	$5 000 000	1½ % Q.	104	105
Allentown Pa.–July 29						
Allentown & Lehigh Val. Trac Co		4,000,000	1,600,000	......	—	15
Bridgeport, Conn–July 29						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug.,	100	...
Baltimore Md–July 29						
a United Rail ways & Elec. Co...com	50	24,000,000	18,000,000	....	16	16¼
Boston, Mass.–July 29						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15,	...	..
North Shore Traction Co...com.	100	4,000,000	4,000,000	....	15	16
North Shore Traction Co...pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	85	87
b West End Street Ry. Co...com.	50	10,000,000	[illegible]	3½ % S., Oct.,	95	95¼
West End Street Ry. Co...8 % pfd.	50	[illegible]	6,400,000	4 % S., Jan.	110	110⅛
Boston Elevated R. R.	100	10,000,000		2½ % Aug. 99,	186	187
Brooklyn N. Y.–July 29						
Brooklyn City Ry	100	2,000,000	1,928,400	....	241	245
Brooklyn Rap. Transit Co., tr certf.	100	48,000,000	48,000,000	....	77	77¼
cBrooklyn Heights Railroad	....	200,000	200,000	....	107	109
*dBrooklyn City RR...guar	100	12,000,000	12,000,000	3½ % Q., Jan.,	287	289
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	2,000,000	1,884,200	2½ % Nov.,	325	330
Kings County Elevated	....	4,750,000	4,750,000	....	..	...
Kings County Traction Co	100	4,500,000	4,500,000	1 % July	..	..
Nassau Electric Railroad...pfd.	......	6,000,000	6,000,000	....	82	83
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo N. Y.–July 29						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	74	75
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q Dec.	99	100
Columbus O–July 29						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Feb.	38	39
Columbus Street Railroad, pfd	100	1,500,000	1,500,000	....	100	102
Charleston, S. C.–July 29						
Charleston City Ry. Co	50	100,000	100,000	3 % S.	—	..
Enterprise City RR. Co	25	1,000,000	250,000	....	—	—
Chicago, Ill.–July 29						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31,	250	260
Chicago & South Side R. T. RR	100	10,328,800	10,328,800	....	..	..
Lake Street Elevated RR.	100	10,000,000	10,000,000		13¾	14
Metropolitan West Side Elev. Ry	100	15,000,000	7,000,000	Feb 28 1900.	34½	35
Met. West Side El., pfd	100	15,000,000	9,000,000	....	89	90
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Jan.	[illegible]	210
hNorth Chicago City Rd	100	500,000	249,900	....	200	201
South Chicago City Railway	100	2,000,000	1,608,200	....	108	109
West Chicago St. RR. Co.	100	20,000,000	13,189,000	1½ % Q. Feb.	100	101
Union Traction Ry...com	...	1,250,000	624,900	35 %	15½	15¾
Union Traction Co...pref	100	2,000,000	2,000,000	5 % S.	57	59
Cincinnati, Ohio.–July 29						
Cincinnati Inc. Plane Ry...com	50	1,000,000	875,000	....	..	..
Cincinnati Inc. Plane Ry...pfd.	50	150,000	150,000	½ % Feb.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	3,000,000	3,500,000	2½ % Feb.	75	76
iCincinnati Street Ry. Co.	50	18,000,000	14,000,000	1¼ % Q., Jan.	124½	125
Mt. Adams & Eden Park Inc. Ry	50	2,500,000	2,200,000	1½ % Q., Jan.	126½	127
Cleveland, Ohio–July 29						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan.	48	50
Cleveland City Ry	100	8,000,000	7,600,000	3-5 % Jan.	100	102
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct.,	80	81
Detroit, Mich.–July 29						
Detroit Citizens' Street Ry	100	2,000,000	1,200,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	....	1,200,000	....	175	..
Rapid Railway Co	....	250,000	250,000	....	90	109
Detroit Electric Railway	....	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.–July 29						
City Railway Co...com	100	1,500,000	1,470,600	1¼ % Q.	140	145
City Railway Co...pf	100	600,000	600,000	1½ % Q.	170	..
People's Street Railway		1,100,000	1,100,000	......	114	115

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Hartford Conn–July 29						
Hartford Street Ry. Co	100	$4,000,000	$200,000	3 % S., Oct.,	150	—
Hartford & West Hartford	100	1,000,000	247,000	....		—
Holyoke Mass.–July 29						
Holyoke Street Ry. Co	100	400,000	400,000	4 % A., June,	[illegible]	112
Hoboken N. J.–July 29						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	3 %,	180	—
Indianapolis, Ind–July 29						
**Indianapolis Street Ry	....	5,000,000	5,000,000	....	25	[illegible]
Lancaster, Pa.–July 29						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	.
Lancaster & Col. Electric Ry	....	....	87,300	....	—	.
West End Street Railway	....	....	....	....	..	.
Louisville, Ky.–July 29:						
Louisville Ry...com	100	4,000,000	3,500,000	1¼ %., April.	82	83
Louisville Ry...pfd	100	2,500,000	2,500,000	2½ % S., Oct 1,	112	[illegible]
Minneapolis, Minn.–July 29						
Twin City Rapid Transit...com.	100	17,000,000	16,010,000	....	89	89¾
Twin City Rapid Transit...7 % pfd	....	3,000,000	1,712,100	1¾ %. Oct.	[illegible]	[illegible]
Montreal, Canada.–July 29						
Montreal Street Ry. Co	50	4,000,000	4,000,000	5 % S., M. & N.	279	280
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1¾ % S., J. & J.	[illegible]	[illegible]
Memphis Tenn.–July 29						
Memphis Street Railway Co	100	500,000	500,000	....	21	—
New Haven, Conn.–July 29:						
Fair Haven & Westville RR.	25	2,000,000	2,000,000	3 % S., Sept.	59	61
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July	...	...
New Haven & Centerville	100	700,000	500,000	....	..	—
Winchester Avenue RR.	25	1,000,000	600,000	....	45	46
New Orleans, La.–July 29						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., July,	..	..
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Oct.	148½	150
New Orleans Traction Co new com.	100	....	....	....	26	28
New Orleans Traction Co new pfd.	100	....	......	....	102	103
aCrescent City RR...guar.	100	2,000,000	2,000,000	3 % S., Jan.,	[illegible]	[illegible]
bNew Or. City & Lake RR...guar.	100	2,000,000	2,000,000	4 % S., Jan.,	..	—
Orleans Railroad	50	500,000	185,000	1½ %., June,	..	52
St. Charles Street Railway	50	1,000,000	1,000,000	1¼ %. Oct.,	[illegible]	[illegible]
New York–July 29						
Central Crosstown RR.	100	600,000	600,000	2½ % Q.	255	260
cChristopher & 10th Sts. RR...guar.	100	650,000	650,000	2 % Q., Oct.,	[illegible]	86
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Nov.	120	[illegible]
dMetropolitan Street Ry. Co	100	45,000,000	45,000,000	2½ % Q., Feb., 1901.	168½	168¾
eBleecker St. & Fulton F. Ry. guar	100	900,000	900,000	¾ % A., July.	[illegible]	[illegible]
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	241	249
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	[illegible]	2¼ % Q.	205	[illegible]
hEighth Avenue RR.	100	1,000,000	[illegible]	....	400	410
i42d St. & Grand St. Ferry RR. guar	100	750,000	[illegible]	4½ % Q.	[illegible]	402
jNinth Avenue RR...guar.	100	800,000	[illegible]	....	198	200
kSixth Avenue RR...guar	100	2,000,000	[illegible]	....	[illegible]	[illegible]
lTwenty-third St. R. R. Co...guar.	100	600,000	[illegible]	4½ % Q.	[illegible]	410
Second Avenue RR.	100	2,500,000	[illegible]	2 % Q., Jan.,	210	212
Third Avenue RR.	100	12,000,000	[illegible]	$1.75 p. sh. Feb.	[illegible]	[illegible]
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	[illegible]	....	65	75
*Union (Huckleberry) Ry.	100	2,000,000	[illegible]	....	190	200
Newark N. J.–July 29						
Consolidated Traction Co of N. J.	100	15,000,000	[illegible]	....	67½	68
North Jersey Railway Co.	100	6,000,000	[illegible]	....	24	25
United Elec. Co. of New Jersey	100	504,000	504,000	11½ % A.	283½	284
Pittsburg, Pa.–July 29						
Allegheny Traction Co	50	500,000		....	27	28
oConsolidated Traction Co...com.	50	15,000,000		2 %, Jan.	20	21
Consolidated Traction Co...pfd.	50	9,478,850		3 %, Nov.	59	60
pCentral Traction Co.	50	1,500,000		1½ % Nov.	78	76¼
qCitizens' Traction Co	50	3,000,000		5 % A.	72	72½
rDuquesne Traction Co	50	3,000,000		5 % A.	..	...
sPittsburg Traction Co.	50	2,500,000		3½ %, Nov.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000		2½ %, July,	27	29
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000		2 %, Aug.	..	..
Pittsburg & Birmingham Trac. Ry.	25	1,500,000		1 %, Oct.	41	42¼
Pittsburg & West End Ry.	50	3,000,000		5 % A., June	..	.
United Traction Co...com.	50	17,000,000		J. & J.	18¾	18¾
United Traction Co...pre	50	3,000,000		J. & J.	61½	[illegible]

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* Unlisted. † Ex div.

a The United Railways & Electric Company comprises in its organization the Baltimore Consolidated Railway Company, the Baltimore City Passenger Railway Company, all the lines of street railway operated by these companies, and also the Central Railway Co of Baltimore. The pref stock of U R & Elec Co has been issued in the form of income bonds.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave RR and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250 100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranted by West Chicago Street Railway Company, lessee.

l Cincinnati St. Railway purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‖ Outstanding. ‡ Ex-div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Ry. at 8 % on stock until Oct. 1, 1897; thereafter 9 %.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1893, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter.

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 % on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens' Duquesne, Fort Pitt & Pitt'b Traction.

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock.

s Leased to Consolidated Traction Company for 7 % on capital stock.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.–July 29						
Union Street Railway Co..........	100	$350,000	$350,000	2%, Feb.	160	165
Northampton, Mass–July 29						
Northampton Street Ry..............	100	800,000	235,000	4% A., June.	170	178
Omaha, Neb.–July 29						
Omaha Street Ry....................	100	5,000,000	5,000,000	3% A. and N.	55	65
Paterson N. J.–July 29						
Paterson Ry. Co....................	100	1,250,000	1,250,000	....	54	--
Providence, R. I.–July 29						
United Traction & Electric Co	100	8,000,000	8,000,000	¾%, Oct.	109	110
Philadelphia.–July 29						
Fairmount Park Trans. Co...$50 pd.	50	2,000,000	1,770,000	2%, Dec.	23	24
Hestonville, Man. & Fairmount....	50	1,966,100	‖1,966,100	2½%, July 15,	47	48
Hest'nvl'e, Man. & Fairm't..6% pfd.	50	588,900	‡588,900	3% S—July,	75	76
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3% Feb. 1,	26½	27
Union Traction Co.............$12½ pd	50	30,000 000	29,980,450	....	30	30½
cElectric Traction Co..............	50	....	8,297,920	....	..	...
dCitizens' Passenger Ry........	50	500,000	†192,500	$8 share Q.	345	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.	450	451
fLehigh Avenue Ry. Co.........	50	1,000,000	....	....	48	...
fLombard & South Street Ry...	25	....	1,000,000	A. & O.	90	90½
dSecond & Third Streets Ry....	50	1,060,000	†771,076	$9 share A, Mar.	300	...
ePeople's Traction Co..........	50	10,000,000	†6,000,000	3%, A., April,	...	..
gGermantown Passenger Ry....	50	1,500,000	‖572,800	$5.25 share—	150	151
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3% Jan.,	151	152
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co........	50	30,000,000	‖20,000,000	$2 p. sh. Oct.	95	95¼
jCatherine & Bainbridge St......	50	....	‖400,000	6% A—Mar.,	...	..
jContinental Pass. Ry.....guar..	50	1,000,000	‖380,000	$6 share—July	168	157
Empire Passenger Ry. Co......	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry.....	50	1,000,000	‖475,000	$7.50 share July	208	208¼
jPhiladelphia & Gray's Fy. RR..	50	1,000,000	298,650	$8.50 share July	100	..
jRidge Avenue Passenger Ry....	50	750,000	‖420,000	$12 share, July	308½	309
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '	...	..
j17th & 19th Sts. Pass. Ry. guar...	50	....	‖250,000	1½% S., July, '	..	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖385,000	$11 sh. A., July,	300	..
jUnion Passenger Ry. Co.........	50	1,500,000	‖900,000	$9.50 shre, July	239	240
jWest Philadelphia Pass. Ry.....	50	750,000	‖750,000	$10 share, July '	262	268
Rochester, N. Y.–July 29						
Rochester Railway Co..............	100	5,000,000	5,000,000	....	25	28
Reading, Pa.–Junly 29						
jjReading Traction Co...............	..	1,000,000	1,000,000	Semi-an.,Jan. & Jy	24	26
kCity Passenger Ry..................	50	850,000	850,000	Jan.,	133	...
lEast Reading Electric Ry..........	50	1,000,000	‡1,000,000	Jan.,	70	--
St. Louis Mo.–July 29						
Fourth Street & Arsenal Ry.......	50	800,000	150,000	....	--	--
Jefferson Avenue Ry. Co...........	50	400,000	400,000	2% Dec.	--	--
Lindell Ry..............................	100	2,500,000	2,400,000	1¼% Jan.	--	--
National Railway Co.................	--	2,500,000	2,479,000	1½% Jan.	--	--
Cass Avenue & Fair Grounds....	..	2,500,000	2,500,000	....	..	--
Citizens' RR..........................	100	2,000,000	1,500,000	1%, Oct.,	..	--
St. Louis RR..........................	100	2,000,000	2,000,000	2½%, Jan.,	..	--
Missouri RR...........................	50	2,400,000	2,300,000	1½% Jan.,	--	--
People's RR. Co......................	50	1,000,000	800,000	50c., Dec.,	..	...
United Electric Ry..............com.	50	500,000	500,000	....	24	25
United Electric Ry........5% pref.	100	1,000,000	1,000,000	3%, Jan.,	78¼	79
St. Louis & Suburban Ry...........	100	3,000,000	2,500,000	....	90	93
Union Depot RR......................	100	4,000,000	4,000,000	3% A., July,	--	--
San Francisco, Cal.–July						
California St. Cable RR.............	100	1,000,000	600,000	50c. monthly.	117	119
Geary Street Park & Ocean RR......	100	1,000,000	875,000	$2.50 share,	50	--
Market Street Ry.....................	100	18,750,000	18,750,000	Q., 60c. per share.	61½	63⅛
Presidio & Ferries RR...............	100	1,000,000	550,000	....	--	16
Scranton Pa–July 29						
Scranton Railway Co................	50	6,000,000	2,500,000	....	29	30
mScranton & Carbondale Trac. Co..	100	500,000	500,000	....	16½	...
mScranton & Pittston Traction Co..	100	1,050,000	1,050,000	....	--	--
Springfield Ill.–July 29						
Springfield Consolidated Ry	100	750,000	750,000	....	....	--
Springfield O.–July 29						
Springfield Street Ry..................	100	1,000,000	1,000,000	....	--	11
Springfield, Mass.–July 29						
Springfield Street Ry.................	100	1,200,000	1,166,700	% A.	407	412
Toronto Canada.–July 29						
Toronto Street Ry.....................	100	6,000,000	6,000,000	1¾% S.	109¼	110⅝
Montreal Street Railway Co.........	.....	4,000,000	4,000,000	4% S.	279	280
Washington, D. C.–July 29						
Belt Ry. Co.............................	50	500,000	500,000	....	..	..
Capital Traction Co..................	100	‡12,000,000	12,000,000	65c. per sh, Oct.	103⅛	103⅞
Columbia Ry. Co......................	50	400,000	400,000	6% A.	--	...
Eckington & Soldiers' Home Ry....	50	707,000	652,000	....	35	40
Georgetown & Tenallytown Ry.....	50	200,000	200,000	....	20	21
Metropolitan RR. Co..................	50	1,000,000	458,900	2½% Q.	--	--
Worcester, Mass.–July 29						
*Worcester Traction Co........com.	100	3,000,000	3,000,000	....	32¼	35
Worcester Traction Co......6% pfd.	100	2,000,000	2,000,000	3% S., Feb.,	107	108
Worcester & Suburban Street Ry...	100	550,000	542,500	4½%,	...	85
Wilkesbarre, Pa.–July 29						
Wilkesbarr & Wyoming Val Trac..	100	5,000,000	5,000,000	1%, Jan.,	25	26

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* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex-div.

a Leased to Hestonville, Man & Fairmount Passenger Ry. for 6% on stock per annum.

b Consolidation Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Company at a rental of $10,000 per annum in 1866-7-8, p.a. $20,000 in 1899-1900 and $30 000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10% guaranteed by Reading Traction Company.

l Dividend of 6% guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Co., formerly Scranton Traction Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.–July 29						
American Tel & Tel Co	100	0,000,000	3,5 0,000	4½% Q., Jan.	159½	160
Erie Telegraph & Telephone Co	100	......	-- ...	1% Q., Feb 20,	48	48½
New England Telephone Co.........		0,294,600	10,304,600	$1.50 p. sh. Feb	139	140
New York.–July 29						
American Telegraph & Cable Co...	100	14,000,000	14,000,000	1½% Q	91	94
*Central & South Am. Teleg. Co.....	100	6,500,000	6,500,000	1½% Q.	100	105
*Commercial Cable Co................	100	10,000,000	10,000,000	1¾% Q.	176	175
Franklin Teleg. Co......2½% guar.	100	1,000,000	......	1¼% S.	42	50
Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1% Q., Feb.,	..	..
*Gold & Stock Telg. Co..guar. 6%.	100	5,000,000	......	1½% Q.	108	109
*International Ocean Tel Co.guar6%	100	3,000,000	......	1½% Q.	116	118
Mexican Telephone Co...............	100	2,000,000	.....		2	2½
*New York & New Jersey Tel. Co..	100	5,000,000	3,728,000	2½% Q., Jan.,	68	178
*Pacific & Atlantic Teleg..guar. 4%	25	2,000,000	......	3% S.	70	75
*Postal Telegraph Cable Co.........	100	15,000,000	15,000,000	1% Q.	..	
*Sout'n & Atlantic Telg. Co.guar.5%	25	950,000	559,525	2½% S.	95	00
†Commercial Union Telegraph Co...	25	500,000	500,000	3% S., Jan.,	115	
Western Union Telegraph Co........	--	......	97,370,000	1¼%, Q. Jan.	92⅛	92¼
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.–July 29						
American Dist. Teleg. (Phila.).....	25	400,000	.....	1% Q.	26	37
Bell Teleph. Co. (of Canada.).......	100	3,960,000	3,56 ,000	2% S.	188	.
Chesapeake & Potomac Telep. Co..	100	......	......	..	67	70
Chicago Telephone Co................	100	......	......	....	200	210
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	...	148	150
Empire & Bay States Telegraph Co.		......	......	..	75	76
Hudson River Telephone Co........	109	2,000,000	2,000,000	% Q	120	125
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½% Q	122	125
Providence (R. I.) Teleph. Co.......	50	.....	......	.	96	99
Southern New Eng. Teleph. Co ...	100	8,000,000	......		...	--

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.–July 29						
Fort Wayne Electric trust receipts..	..	......	......	..	115	125
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	..	15	25
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2% Q., Aug., 1898.	..	..
General Electric Co. [new]...... "	100	18,276,000	18,276,000	1½% Q., Apr., 1901	255⅛	2 3
T.-H. Elec. Co..T. Secur., Series C.	..	......	......	...	22	28
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	..	70	70½
Westinghouse El. & M'g. Co. pfd.	50	4,000,000	3,996,058	1¾% Q.,	75¾	76
Westinghouse El. & M'g. Co. rights.	50	11,000,000	8,195,126	.....	1¾	1⅞
New York.–July 29						
Edison Elec. Ill'g Co., New York..	100	9,188,000	7,958,000	...	119	120
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	2,000,000	1½% Oct., '98	.	..
Edison Ore Milling Co...............	100	......	......	....	8	12
Electric Vehicle Co..............com.	..	......	......	...	--	--
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2% Q., Aug., 1898.	.	...
General Electric Co. [new].... "	100	18,276,000	18,276,000	1½% Q.,Apr., 1901	254	254⅛
Interior Conduit & Insulation Co...	100	1,000,000	1,000,000	..	41	--
‖ Kings Co. El. L. & P. Co.	100	2,500,000	2,500,000	A. & O.	110	125
Pittsburg, Pa–July 29						
Allegheny County Light Co	100	500,000	500,000	J. & J.	168	172
East End Electric Light Co.........	50	800,000	600,000	Q	--	--
Philadelphia, Pa.–July 29						
Edison Electric Light Co............	100	2,000,000	.....	.....	144	144½
*Electric Storage Battery Co..com.	100	8,500,000	.....	.....	75	80
*Electric Storage Battery Co...pfd.	100	5,000,000	.....	.....	75	80
Northern Elec. Light & Power Co..	10	550,000	550,000	.....	13	18⅛
Southern Elec. Light & Power Co..	10	187,500	187,500	..	30	--
Miscellaneous.–July 29						
Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	.....	.....	47	48
Missouri-Edison (St. Louis)....com.	..	......	......	..	20	21
Eddy Electric Mfg. Co...............	25	......	......	....	9	12
Hartford (Conn.) Elec. Light Co....	100	850,000	......	....	190	191
Hartford (Conn.) Lt. & Power Co..	25	175,000	......	....	6	10
New Haven (Conn.) Elec. Lt. Co....	100	100,000	......	....	195	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2% Q., Oct.,	103	101
Rhode Island Elec. Protec. Co.......	100	......	......	....	118¼	120¼
Royal Elec. Co. (Montreal)..........	..	1,000,000	.....	3% Q	‡250	251
Toronto (Canada) Elec. Light Co...	100	1,085,000	1,085,000	1¾% Q	136	138
Thomson-Houston Welding Co.......	100	......	......	3% S, Dec. 1,	..	100
Woonsocket (R. I.) Electric Co.....	100	......	......	....	105	106

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

‖ Recently acquired the Edison Illuminating Co. of Brooklyn and its constituent company, the Municipal Electric Light Co.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.–July 29						
American Electric Heating Co.........	50	10,000,000	....	....	--	--
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh.	--	--
United Electric Securities Co...pfd.	100	......	1,000,000	$3.50 p.sh.	--	100
New York.–July 29						
Consolidated Electric Storage Co...	...	......	....	....	8	12
Safety Car Heating & Lighting Co..	100	......	....	......	150	155
Worthington Pump Co.........com.	100	5,500,000	5,500,000	......	..	-
Worthington Pump Co...........pfd	100	2,000,000	2,000,000	7% A	113	114
Philadelphia Pa.–July 29						
Electro Pneumatic Trans. Co	10	1,500,000	.....	--	2	2⅛
United Gas Improvement Co..scrip.	50	10,000,000	.....	--	..	162
Welsbach Commercial Co.....com.	100	3,500,000	.....	--	20½	21½
Welsbach Commercial Co......pfd.	100	500,000	.....	2% Q	73	75
Welsbach Light Co..................	5	525,100	......	....	54	55
Welsbach Light Co., Canada.	5	500,000	......	....	1	1¼
Pittsburg, Pa.–July 29						
Carborundum Mfg. Co...............	100	200,000	200,000	....	--	
Standard Underground Cable Co...	100	1,000,000	1,000,000	Q	224	225
Miscellaneous.–July 29						
*Barney & Smith Car Co.......com.	100	......	1,000,000	--	20	25
*Barney & Smith Car Co ....pfd.	100	......	500,000	2%	120	129
Billings & Spencer Co...............	25	......	....	....	32	
Consol. Car Heating Co.............	100	1,250,000	1,250,000	1½% Feb	54	56½
Johns-Pratt Co........................	100	....	....	--	105	109
*Pratt & Whitney Co...........com.	100	......	....	--	..	
*Pratt & Whitney Co............pfd	100	....	......	--	85	90
Stillwell-Bierce Co...............com	--	....	....	--	--	50
Stillwell-Bierce Co................pfd.	--	....	....	2% Sept	65	70
Shults Belting Co......................	100	500,000	....	....	80	90
St. Charles Car Co.....................	-	....	....	.....	80	84

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany N. Y.

Date of Quotation—July 29 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry. Co......Cons. mtg. 5s	$500,000	427,500	1940	J. & J.	117⅛	......
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*116⅛	......
‖Watervleit Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N	*125	
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N	*124	126
Troy City Railway Co...................1st 5s	....	....	1942	.....	*116½	118

‡Interest guar. by Albany Ry. Co.

‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—July 29. 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
United Electric Ry. Co...1st mtg. g. 4s	88,000,000	18,000,000	1949	M. & S.	102	102¾
" " " ....income 4s.	14,000,000	....	1949	J. & D.	74¾	75
Baltimore City Pass. Ry..1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	118⅞	
†Baltimore Traction Co......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	119	120
†Baltimore Trac. Co. Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	104⅛	......
†Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	121	121⅛
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1909	J. & J.	101	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	102⅛	......
†Central Pass. Ry. Co.........1st mtg. 6s.	96,000	117,000	1912	J. & J.	.....	....
†Central Pass. Ry. Co..Cons. mtg. g. 5s.	604,000	580,000	1982	M. & N.	119	121
†City & Suburban Ry.....1st mtg. g. 5s.	8,000,000	8,000,000	1922	J. & D.	116	117
†Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	117	......

☞ All of the bonds of the above companies, marked †, have been assumed by the United Railways & Electric Company.

Boston Mass.

Date of Quotation—July 29, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	114	115
West End Street Ry.........Deben. g. 5s.	8,000,000	3,000,000	1902	M. & N.	104⅛	106
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S	112	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies

Charleston S. C.

Date of Quotation- July 23, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry.......... 1st mtg. 6s.	850,000	....	....	J. & J.	106	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—July 29, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry..............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¾	2¾
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry....Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T....1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T..............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1982	J. & J.	108⅛	109
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	8,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A	96	96⅛
North Chicago St. RR.........1st mtg. 5s.	8,171,000	8,171,000	1906	J. & J.	106	......
North Chicago St. RR.....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	......
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.		......
North Chicago City Ry......consol. 4½s.	2,500,000	2,500,000	1927	M. & N	108	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	8,969,000	1928	M. & N	......	111
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D	101	102
West Chicago St. RR.....Con. mtg. g. 5s.	12,500,000	6,000,000	1986	......	106⅝	107
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	...	....

†Redeemable at option on 60 da. notice.

‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.

¶Subject to call after Oct. 1, 1899, at $110 and interest.

‖Assumed by W. Chi. RR. Co., lessee.

§Int. guar. by W. Chicago St. RR. Co

Cincinnati O.

Date of Quotation—July 29 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	8,000,000	2,500,000	1922	J. & J.	114⅛	115
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103⅛	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	114	......
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	581,000	581,000	1906	M. & S.	108¾	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	121⅛	122⅛
‡So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1982	J. & J.	182¾	187

†Assumed by the Cincin. St. Ry. Co.

‡$250,000 reserved to retire 1st mtg. bds.

Cleveland O.

Date of Quotation - July 29 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S	106½	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	8,000,000	2,500,000	1922	J. & J.	113½	114⅛
Cleveland City Cable Ry....1st. mtg. 5s	2,000,000	2,000,000	1909	J. & J.	105½	106
‡Cleveland Electric Ry. Co. 1st mtg. g. 5s	8,500,000	1,249,000	1918	M. & S.	106	107
Columbus (O.) Cent. Ry...1st mtg. g. 5s	1,500,000	1,500,000	1918	M. & N.	......	......
aEast Cleveland RR...........1st mtg. 5s	1,000,000	1,000,000	1910	M. & S.	......	107⅛
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s	600,000	....	1922	M. & N	....	...
Lorain (O.) Street Ry........1st mtg. 6s	[illegible]	200,000	1915	J. & J.	....	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s	600,000	600,000	1912	J. & D	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.

‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—July 29, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 6s	7,000,000	8,885,000	1905	A. & O.	......	102⅛
Ft. Wayne & Belle Isle Ry...1st mtg. 6s	400,000	377,000	1902	A. & O	...	
The Detroit Ry.................1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	105	106⅛

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—July 29 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry........1st mtg. g. 5s.	600,000	600,000	1918		111	....
New Haven (Edgewood Div.) 1st. mtg. 5s.	250,000	250,000	1914	J & D	111	......
Winchester Avenue RR—1st mtg. g. 5s	100,000	500,000	1912	M & N	109	......
[illegible]chester Avenue RR......Deben	100,000	34,000	1919	M & S		

With interest Unlisted

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation—July 29 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.... cons mtg. 6s.	$150,000	$150,000	1912	M. & N	......	
Crescent City RR............1st mtg. 6s.	......	50,000	1899	M. & N	105⅛	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	8,000,000	1948	J. & J.	......	...
New Orleans City RR........1st mtg. 6s.	416,500	899,000	1908	J. & D	108	113
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1948	J. & J.	112	118
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A	......	......
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	......	......
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D	......	......

†$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.

‡$90,000 outstanding.

New York.

Date of Quotation—July 29 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1984	J. & J.	95	......
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107⅛	110
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	8,000,000	1,966,000	1981	A. & O.	115	116
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1948	J. & D.	128	125
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	105⅛
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	108	110
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1989	J. & J.	115	116
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1988	J. & J.	101	....
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	......
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	8,500,000	8,500,000	1941	J. & J.	112	....
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	107	....
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	109⅛	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	98⅛	100⅛
Cent P'k, N. & E. R. RR. 1st cons. mtg. 4s.	1,200,000	1,200,000	1902	J. & D.	107	109
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	125	......
Coney Island & Brooklyn RR. 1st mtg. 5s	800,000	800,000	1908	J. & J.	101	108
3D Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1982	J. & D.	117	120
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	100,000	1,100,000	1914	F. & A.	102	105
Eighth Av. RR. Co.....Cert. indebt. 6 %.	000 000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	,200,000	1,200,000	1910	M. & S.	116⅛	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	89	......
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1998	M. & S.	124	125
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	120	......
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	120	121
Second Avenue Ry..............Deb. 5s.	800,000	800,000	1909	J. & J.	108⅛	109
Steinway Ry. (L. I.).........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	116	117
South Ferry RR. Co..........1st mtg. 5s.	850,000	850,000	1919	......	110⅛	112⅛
Third Avenue RR.............1st mtg. g. 5s.	5,000,000	5,000,000	1987	J. & J.	......	128⅛
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	.....	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	106	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	118	116
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1948	J. & J.	110	114

†$1,085,000 in escrow to retire gen. mtg. bonds.

‡$4,850,000 in escrow to retire maturing obligations.

¶$552,000 in escrow to retire 1st and 2d mtg. bonds.

§In treasury, $80,000.

‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—July 29 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry......................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.		
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M & S.		

†$85,000 per m. single track authorized.
$600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—July 29, 19

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry...........1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry...................1st mtg. 7s	800,000	200,000	1900	J. & J.	...	...
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	...	...
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	..	....
People's Pass. Ry...................1st mtg. 7s	250,000	250,000	1905	J. & J.	..	....
People's Pass. Ry.....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1948	...	....	....
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J &	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s.	1,800,000	1,018,000	1917	F. & A	......	......
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co.................Col. tr. 4s.	29,785,000	29,724,876	1945	A. & O.	---	......
West End Passenger Ry....... 1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	......	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	......	......

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg. Pa.

Date of Quotation - July 29 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1981	M. & S.	111⅛	....
Central Traction Co...............1st mtg. 5s.	875,000	875,000	1980	J. & J	......	......
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1980	J. & J.	.....	......
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s	750,000	750,000	1928	M. & N.	110	118
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	118
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	.....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1980	A. & O.	....	....
Second Ave. Traction Co......................5s.	2,500,000	2,000,000	1984	J. & D.	......	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1912	M. & S.	......	

Providence R. I.

Date of Quotation—July 29 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	80,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,260,000	[illegible]	M. & S.	116	118

St. Louis.

Date of Quotation—July 29, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baden & St. Louis RR.........1st mtg. 5s	250,000	250,000	[illegible]	J & J	101⅛	[illegible]
Cass Ave. & Fair Gds Ry......1st mtg. 5s	1,818,000	1,818,000	[illegible]	J & J	101⅛	[illegible]
Citizens' Railway Co.......1st mtg. 5s	2,000,000	1,800,000	[illegible]	J & J	[illegible]	
Comp. Hts. Un. De. & Mer. Ter—1s	1 000 000	000 000	191	J& J	[illegible]	

Unlisted With interest

PASSENGER RAILWAY.

St. Louis

***Date of Quotation*—July 29 1901**

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked
Jefferson Avenue Ry............1st mtg. 5s.	270,000	270,000	1905	M. & N.	102	108
Lindell Ry. Co........................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	108
Missouri RR. Co....	1,000,000	700,000	1916	M. & S.	105	106
‡Mound City RR. Co..............1st mtg. 6s.	400,000	300,000	1910	A. & O.	104½	105½
People's RR. Co......................1st mtg. 6s.	125,000	125,000	1902	J. & D.	..	.....
‖People's RR. Co....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	......	.....
People's RR. Co................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	......	.....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	99½	100½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry................Income 5s.	800,000	800,000	......	....	80	84
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	106	108
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	116½	117½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	100	100½
Union Depot RR. Co..........Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	121	122

†Controlled by St. Louis RR. Co.
‡Controlled by Union Depot RR. Co.
¶Controlled by Lindell RR. Co.
‖$200,000 in escrow to retire 1st & 2d mtg.
§$600,000 in escrow.
††$200,000 in escrow to retire 1st mtg. bds.

San Francisco Cal.

***Date of Quotation*—June 1901.**

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	95
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	126½	.....
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	....
†Omnibus Cable Co..... ....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126½	
†Park & Cliff House RR........1st mtg. 6s.	850,000	850,000	1912	J. & J.	105½	107
†Park & Ocean RR................1st mtg. 6s.	250,000	250,000	1914	J. & J.	115	.....
†Powell St. Ry.........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	.....	125
Sutter St. Ry. Co........ ......1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	...	.....

†Controlled by Market St. Ry. Co.

Washington D. C.

***Date of Quotation*—July 29 , 1901**

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked
Belt Ry. Co............................Cons mtg 5s.	500,000	450,000	1920	J. & J.	......	
Columbia Ry.............................'' mtg. 6s.	500,000	500,000	1914	A. & O.	182	......
Eckington & Soldiers' Home.'' mtg. 6s.	200,000	200,000	1911	J. & D.	......	......
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	......	....

†$50,000 in escrow to retire 1st mtg. bds.

Miscellaneous.

***Date of Quotation*—July 29 , 1901**

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked
Bridgeport Traction Co.........1st mtg. 5s.	2,000,000	1,688,000	1928	J. & J.	108	10
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	118	
‡Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	104	10
‖Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	8,000,000	2,866,000	1932	M. & N.	112	113
¶Columbus (O.) St. Ry.......1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	115	
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	111¼	111⅝
§Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	115	115
Denver City Cable Ry.........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	20	..
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	85
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	119	119½
‖Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	110½	110½
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	8,000,000	2,878,000	1928	J. & J.	108	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	....
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	....
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	....	......
Rochester (N. Y.) Ry........... 1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	......	......
St. Paul City Ry......................Cons. g. 5s.	5,500,000	4,298,000	1937	......	105½	106
St. Paul City Ry......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	108	

†$1,000,000 in escrow to retire 1st and 2d mtg. bds.
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.
¶$760,000 in escrow to retire bonds of C. St. RR. Co.
‖$87,000 in treasury.
§$960,000 res'ved to redeem prior liens
††$620,000 in escrow.

*With int'

ELECTRIC LIGHT AND ELECTRICAL MFG. COS

Boston, Mass.

***Date of Quotation*—July 29, 1901**

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked
Delaware Gas Lt. Co.,..........1st m. 5s, g.	800,000	800,000	......	J. & J.	106	10
Edison Elec. Illuminating Co., Boston...	2,026,000	......		Quar.	157	..
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	116	....

Pittsburg Pa

***Date of Quotation*—July 29 1901**

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked
Allegheny County Light Co.............. 6s.	500,000	......	1911	J. & J.	110	......
Westinghouse Elec. & Mfg. Co.Scrip 6s.	195,570	......	......	M. & S.	....	......

Miscellaneous.—(July 29 1901.)

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	109	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1998	......	124	......
Edison Elec. Illg. Co. (Brooklyn).......	5,000,000	5,000,000	1940	....	122½	124
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	. ..	......
Kings Co. El. Lt. & Pow. Co.1st mtg. 5s.	2,500,000	.....	1937	A. & O.	100	105
Kings Co. El. Lt. & Po. Co.pur. money 6s	5,176,000	....	1997	A & O.	120	122
Milwaukee El. Ry & Lt. Co.1st con. g. 5s.	8,000,000	....	......	F. & A.	102½	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.

***Date of Quotation*—July 29 , 1901**

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked
American Bell Telephone......................4s.			1908	F. & A.	100½	101
NorthwesternTelegraph Co................7s.	....	......	....	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	114	115
Chesapeake & Potomac Teleph. Co....5s.	....	......	1911	J. & D.	108	106

ALLIED INDUSTRIES.

Miscellaneous.

***Date of Quotation*—July 29 1901**

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked
American Electric Heating............. 7s	500,000	500,000	....	....	....	......
Armington & Sims Engine Co.............	....	....	......	......	......	25
Barrney & Smith Car Co.....................6s.	....	....	1942	J. & J.	106	107
Carborundum Mfg Co.........................6s.	......	....	1904	J & D.	......	......
Worthington Pump Co.....	75,000	....	......	....	115	127

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 16⅞@17c.; Lake, 17@17⅛; casting, 16⅝@16⅞c.

Dividend disbursements in Boston on August 1 will aggregate $6,724,893 against $5,848,162 on August 1, 1900.

According to an official of the Chicago Union Traction Company, dividends will be paid on the preferred stock within the next six months.

Earnings of the United Power & Transportation Company of Philadelphia are stated to be making a very favorable showing.

The Chicago Edison Company has declared the regular quarterly dividend of 2 per cent., payable August 1. Books closed July 25 and reopen August 2.

It is reported that the United Traction Company of Reading, Pa., is negotiating for the purchase of the railway interests there of the Shepp Brothers, of Philadelphia.

Philadelphia Union Traction transfer books will be closed from August 28 to September 19, inclusive, for the stockholders' meeting which takes place the former date.

The directors of the London Metropolitan Railway have declined the offer of C. T. Yerkes to introduce electricity on their line, and will install electricity on the system themselves.

The Sixth Avenue Railroad Company of the Metropolitan system of New York, has declared a real estate dividend of 38 per cent. payable at once. Books closed on Saturday.

The directors of the Boston Elevated Railway Company on Monday declared a semi-annual dividend of 3½ per cent. This is an increase from a 4½ per cent. to a 7 per cent. annual basis.

The North Hudson County Street Railway Company and the Paterson Street Railway Company have been merged into the Jersey City, Hoboken and Paterson Street Railway Company.

The Westinghouse Electric & Manufacturing Company has declared a quarterly dividend of 1¾ per cent. on its assenting stock, payable August 15. Books close August 6 and reopen August 16.

The title of the Schuylkill Valley Phone Company has been changed to the Consolidated Telephone Companies of Pennsylvania, and the capital stock is to be increased from $400,000 to $4,000,000.

The regular quarterly dividend of 1½ per cent. on the West Chicago Street Railway Company's stock, guaranteed by the Chicago Union Traction Company, will be paid on August 15. Books close August 5.

The New England Telephone and Telegraph Company has declared a regular quarterly dividend of 1½ per cent., payable August 15. Transfer books close from August 1 to August 14, both days inclusive.

The steel strike situation is much improved. Conferences between Mr. Morgan and President Shaffer of the Amalgamated Association have apparently resulted in a satisfactory understanding, and the great strike is therefore practically ended.

The Boston Edison Electric Illuminating Company has notified the Old Colony Trust Company to receive deposits of Boston Electric Light Company stock under terms of consolidation with the Edison until further notice. The time previously set for depositing expired July 24.

The following are quotations for some of the industrial stocks not quoted elsewhere: Electrical Lead Reduction, 1¾@2½; Electric Boat, 16@19; Electric Vehicle, 6@8; Tel. & Tel. Company of America (full paid), 4@6¼; Electric Company of America, 7¼@7½; National Carbon, 16¾@17.

We understand, says the Boston "News Bureau," that directors of the Telephone, Telegraph and Cable Company of America will meet early in August to consider the reorganization of the company. It is planned to raise additional capital and actively push the business of the company.

The Boston Stock Exchange gives notice that the stock of the Boston Electric Light Company has been dropped from the list, and that it has admitted for quotation on the unlisted sheet the certificates of deposit for this stock issued by the Old Colony Trust Company, which will constitute a good delivery.

The Electric Company of America reports that the June net earnings of the 13 plants which it is operating show an increase of 23 per cent. over those of the corresponding month in 1900. An advocate of a plan to make Electric Company of America stock full paid says the interests he represents are not likely to press this matter before cooler weather--next fall.

The Boston Stock Exchange has listed 62,376 shares of the Cumberland Telephone and Telegraph Company, of an authorized issue of 100,000 shares. The company is a consolidation of the Cumberland Telephone and Telegraph Company, the Great Southern Telephone and Telegraph Company, and the Ohio Valley Telephone Company. The company has regularly paid dividends upon its stock from September 22, 1883, the total amount so paid being $1,853,203, the last three dividends being at the quarterly rate of 1¾ per cent.

Morrison, Kekewich & Co., a copper firm of London, write: "Copper has gradually improved under persistent purchases on behalf of consumers, and quiet absorption of standard by the American representatives. Bi-monthly statistics show a small increase in the visible supply of 27 tons--some 2,000 tons of furnace material arrived and were included. This copper is sold and is now being delivered-- for the whole month a substantial decrease is expected. Owing to the remunerative prices obtainable for electrolytic, a large quantity of standard is being withdrawn from the warehouse and shipped to America for conversion."

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EDITORIAL NOTES.

The American Institute Meeting. Arrangements have now been completed for holding the Eighteenth Annual Convention of the American Institute of Electrical Engineers. The meeting will take place in Buffalo between August 20 and 24. On August 14, however, the members will meet at the Society's headquarters in 31st street, New York, where the registration and distribution of badges will take place. On August 15 visits will be paid to various places of interest in the neighborhood, such as the Crocker-Wheeler Works at Ampere, N. J., the power stations of the Manhattan and Metropolitan Railways, etc. On Friday August 16 the members and their guests will visit the principal exchanges of the New York Telephone Company as well as several of the central stations of the New York and Brooklyn Edison Companies. No special assignment has been made for Saturday in order to enable visitors to make their own arrangements for sightseeing and recreation.

At 9 A.M. on Sunday, the 18th, the party will meet on board the special steamboat Montauk at the foot of West 42d street and proceed up the Hudson River, arriving at Albany about 6 o'clock in the evening. The following morning the members will leave Albany by special train for Schenectady where the works of the General Electric Company will be visited. Leaving Schenectady immediately after luncheon, the party will arrive in Buffalo by night.

The following morning the general meeting will open at Buffalo, in the Temple of Music, with addresses by the Exposition and municipal officials. A preliminary visit will be made to the Exposition in the afternoon. On the three following days there will be sessions for the reading and discussion of papers in the forenoons. The Exposition officials have designated August 22 as Electrical Day.

Although only morning sessions of the Convention will be held, the afternoon being utilized in visiting installations or sightseeing, it is expected that much good matter will be gone over and discussions of interest elicited.

An agreeable feature of this year's Convention will be the presence of a number of European engineers, who come over through the efforts of "L'Eclairage Electrique" of Paris. This French party of engineers will leave Buffalo for Chicago on August 25, spending Monday and Tuesday in Chicago. Returning to Kingston, Ont., the party will continue down the St. Lawrence, stopping at Montreal August 30 and 31 and Quebec September 1.

* * *

Light from Refuse. Five years ago people would have laughed to scorn the idea of converting the refuse and garbage collected on narrow and dirty streets of a community into brilliant light, and yet this is just what is being done every night of the year at Shoreditch, a vestry of London, and at other places in England.

In New York City, as is well known, various methods have been tried for disposing of ashbin refuse, none of which may be said to have proven entirely satisfactory from both a hygienic and financial standpoint. At one time the daily accumulation of garbage was loaded upon scows and towed to Riker's Island where it was dumped, the inhabitants on the upper east side being obliged to put up with obnoxious odors every time the wind happened to be from that direction. As a natural result complaints became numerous during the summer months and this method of disposal had to be abandoned.

An attempt was then made to rid the city of its garbage by dumping at sea, but complaints again arose, as only too frequently a portion of the refuse was brought back by wind and tide to the very shore from which it had been taken.

The Barren Island scheme next made its appearance, which consists, in a word, in boiling and cooking the vegetable and animal matters with a view to ultimately turning them into grease and other salable substances. Considerable has appeared from time to time in the daily press on this method of disposal, due to the complaints of residents at Rockaway Beach and other summer resorts in that vicinity, who objected to the process on the same grounds that the dwellers along the upper east side objected to the dumping on Riker's Island. At the present time a small portion of the garbage of New York City is burned after everything of a marketable value, such as tin cans, rags, etc., has been removed. This is certainly a step in the right direction from a sanitary standpoint, but still leaves much to be desired from a financial point of view, and it is in this that our English cousins have gone us one better and have developed the so called garbage destructor, which may truthfully be said to be the only known means of refuse disposal that satisfies both sanitary and economical requirements.

These destructors, as explained from time to time in these columns, consume without giving off disagreeable orders, the refuse of a district, that is made to generate steam and produce electric current which may be made to operate arc lights throughout the district from which the garbage is collected.

The value of this method of disposing of a city's refuse should not be overlooked at a time when those in authority in this city contemplate having the New York Sanitary Utilization Company dispose of the city's refuse at a cost of $322,000 a year. This means that the Barren Island scheme will continue to flourish in spite of the fact that the Legislature of last year passed a bill condemning the plant as a nuisance, which bill, however, was held unconstitutional by the court. There is talk of the city buying the plant, which is absurd, for, as a writer in the N. Y. "Herald" recently said when referring to this subject, "If the next Legislature heeds the complaints of the 'Barren Island nuisance,' and enacts a measure that is not unconstitutional where will the city be? It will be free to create a new plant at its own expense, while the coterie of inside owners of the existing outfit will have the people's money."

Instead of spending hundreds of thousands of dollars on an antiquated outfit or for the disposal of garbage, let our city fathers authorize the construction of a destructor plant such as are in successful operation in England and try the experiment of generating electricity at practically no cost.

* * *

A Proposed Power House Not Wanted.

The Manhattan Elevated Railroad Company of this city proposes to erect a power house on Morningside Heights, in the vicinity of the Cathedral St. John the Divine and St. Luke's Hospital. This contemplated action on the part of the railroad company has resulted in a hue and cry being raised by the owners of real estate in that neighborhood.

The power house is to be of red brick four stories in height. In design, says a daily paper, which treats the subject in a sarcastic humor, it is to be early Manhattan Renaissance, slightly altered by the addition of a seven-story chimney, that next to the choir loft of the Cathedral will be the most conspicuous landmark on the heights. In other words, special effort will be made by the architects to have the power house in striking contrast to the noble Cathedral on which millions are to be spent.

The power house will, on the other hand, cost $52,000. Referring to this subject the N. Y. "World" recently said:

"In spite of this bit of enterprise on the part of the Manhattan officials, the property owners in the vicinity, evidently not fully appreciating what is to be done in their behalf, have raised a cry of indignation and there have been threats to call a mass-meeting and to protest against what they call the desecration of the neighborhood. They hope to force the Manhattan people to abandon their cherished public improvement. The company officials say that this indignation on the part of the property owners arises from a misconception of the plans the company has in view. When these are more generally understood, they say, opposition will disappear and cooperation will take its place."

A prominent real-estate owner, to whom the beauties of the brick power-house with the ornate chimney do not appeal, is reported as saying that unavailing efforts have been made to have the "L" people turn the plot into a park. Its present condition has decreased real estate values in the neighborhood 25 per cent., he says. The Manhattan directors have failed to impress him with the fact that a power house on the site will restore to the neighborhood its lost prestige.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

President Vreeland of the Metropolitan Street Railway of New York will be examined on September 4 at Albany by Referee Earl in the special franchise tax litigation. Mr. Vreeland's testimony will close the case.

Ten of the new automobile stages that are to take the place of the old Fifth avenue stage coaches in this city will be in operation by September 1, a month later than they were promised by the New York Electric Vehicle Transportation Company.

A foreign contemporary states that the Swiss town of Davos proposes to introduce electricity for all industrial and domestic purposes, thus dispensing with fuel of any description. An extensive electrical generating plant would be erected at the confluence of two mountain torrents, and, it is stated, a prominent firm of Swiss electrical engineers has obtained the necessary permission to utilize the torrents for this purpose. The cost of the first installation is put at about $1,700,000.

H. A. Fisher, general manager of the Columbus, London & Springfield, O., Railway Company, asserts that within one year his company, with other interurban companies in which he is interested, will offer through sleeping car service between Columbus and Cincinnati, and within two years there will be such service between Cleveland and Cincinnati. According to Mr. Fisher, the sleeping compartments on the trolley cars will be equal in every way to those on the Pullman. There will be no extra charge for their use.

Construction of telegraph lines in the Philippine Islands is becoming quite a feature of the development of this part of the United States' new possessions. Before the fall of Manila the Spaniards only used the telegraph in the vicinity of that city. Now there are hundreds of miles of wires in every part of the island which has been occupied by American troops. There are nearly 1,000 telegraph offices in the archipelago, and every week new ones are being added. The Filipinos, who were at first hostile to the telegraph lines, have become reconciled to the innovation, and the authorities are having less trouble on account of their depredations. While the lines have been constructed for the use of the military service, at the same time the native business establishments are beginning to use them, the Government making a fair charge for such use. Recently some of the mining concerns and plantation proprietors have combined to construct a line for their own private use.

We learn from the "Morning Post," says the London "Electrician," that the electric railway between Milan and Varese in Italy has just been opened. The distance of 50 miles is covered in 50 minutes, and trial trips have been made with complete success, the train running at 66 miles an hour. Water power is obtained from the Ticino at Tornavento, where three 500 hp. alternators have been fixed. The carriages, which resemble Pullman cars, are furnished with four motors connected with the axles of the four sets of wheels. At level crossings the third rail, along which the current passes, is interrupted, the ends being connected underground by means of a cable. At the stations the third rail is carefully protected from all possible contact with the traveling public.

A dispatch from Boston states that having obtained a special permit from the United States Government, the Boston Submarine Signal Company, which controls the system invented by Arthur J. Mundy and perfected by the late Prof. Elisha Gray, will begin this week the erection of a cable house on Egg Rock, Nahant, and will establish a system of submarine signaling, by which vessels bound into Boston Harbor may determine their position when within ten or twelve miles from the shore, thus escaping the danger of approaching too near dangerous shoals and ledges in the entrance to the harbor.

Advices from abroad state that the first suburban electric railroad in Russia has just been opened for traffic. The new line connects the manufacturing town of Lodz, in Russian Poland, with the neighboring towns of Zgierz and Pabianico, and is 13½ miles long, while the total cost is put at $560,000. It is one of the provisions of the charter that the Russian Government shall receive a share of the profits, also the right to purchase after 20 years, and that the road intact shall become Government property at the expiration of 28 years' time.

It is stated that experiments with wireless telegraphy on board the French Mediterranean fleet have not proved successful; 14 ships have been fitted with the apparatus; messages were only sent 30 miles with anything like precision. Up to the present time the men in the French Channel squadron have made more progress in the use of wireless telegraphy than the men in the Mediterranean fleet.

A magnificent royal car probably the first electric car in the world built especially for royalty—is now under construction by the Ottawa Electric Railway. The company is not sparing expense to make this car one of the best electric cars that has ever run on any track. It is to be finished in a most complete manner, and on the front will be painted the name of the car, "The Duchess of Cornwall," and on either side will be carved the royal coat of arms. The car is to be finished in the royal colors and on the inside, besides the fancy brass work and plate mirrors, will be numbers of wicker and upholstered chairs. The car will carry the royal party to Britannia, where the Ottawa lumbermen will have a timber crib which will be boarded for a trip through Deschenes Rapids and down the timber slides at Chaudiere Falls.

The law enacted at the last session of the Connecticut Legislature regarding automobiles went into effect August 1. It limits the speed of all power vehicles to 12 miles an hour in cities, and fifteen miles on the country roads. If the driver of a horse holds up his hand when meeting an automobile the chauffeur must stop instantly. A penalty of not more than $200 is attached to the statute. Prosecuting Attorney Walsh says that he has had many complaints of strangers traveling through Greenwich on speeding trips to New York and Bridgeport, and that he will cause the arrest of the first one seen speeding on the Boston turnpike.

◆

ONE of the largest contracts ever obtained by an Albany, N.Y., manufacturing company was that awarded last week to the Consolidated Car-Heating Company calling for the entire electric heating equipment of the Manhattan Elevated Railroad Company of this city. The company expects to have 300 cars ready by January 1, 1902. It will take about 18 months to fill the contract.

◆

ON August 1 there was direct communication by telegraph between Ottawa and Dawson City. The several sections of the line which will in the near future be finished into a complete system are from Ashcroft to Quesnel, 220 miles; from Quesnel to Hazelton, 400 miles; Hazelton to Telegraph Creek, 350 miles, and 570 miles from Altin to Dawson, making in all 1,754 miles of line. The south terminus of the line is Ashcroft, and Vancouver messages will be accepted from there.

◆

Mr. Nelson P. Hutch, of Milwaukee, Wis., recently inspected the power possibilities of the Chats Rapids, near Ottawa, with a view to development. This magnificent, undeveloped power has been attracting great attention of late, and it will probably be all utilized before very long. It is one of the finest powers on the Ottawa River.

◆

THE Brooklyn Rapid Transit Company is to use automobiles as repair wagons. An order for the building of twelve wagons of a special design has been placed by the company with a large manufacturing concern. The vehicles are to be ready for delivery by October 1. They are to cost from $2,200 to $2,500 each.

◆

The American Institute Trip.

The following information has been received from the Secretary of the American Institute of the Electrical Engineers regarding the coming convention:

Fare for the trip from New York to Buffalo and return will be $16. This will include transportation on the boat, luncheon and refreshments, and transportation on the train next morning from Albany to Buffalo. It will also include the privilege of sending heavy baggage from New York on Saturday, August 17, from residence in either New York or Brooklyn, with its delivery to hotel room at Buffalo. The return fare will be good for fifteen days from date of issue, returning by any train on the New York Central, except the Empire State Express, the Lake Shore Limited or the Limited Mail.

The rates at the Hotel Ten Eyck, Albany, will be $3.50 for each person for dinner, breakfast and bedroom, without bath, or $6 for two persons. The rate for similar accommodations, with bath in addition, will be $4 for each person. The rates at the Niagara Hotel in Buffalo, on the European plan throughout, will be $3 for one person, in a single room, without bath; for one or two persons, with bath, in a single room, $8 per day; for large suites, with bath, for one or two persons, $10 to $12. For those who cannot be accommodated at the hotel, good rooms will be secured in the neighborhood at rates not exceeding $2 per day for each person.

As far as possible reservations will be made in the order of priority of application, and notice will be given promptly of the character and price of the reservation as soon as made.

Applications for tickets and accommodations should be made as early as possible to Mr. R. W. Pope, Secretary of the Institute, 26 Cortlandt street, New York. Each application should inclose a check, payable to R. W. Pope, for the number of tickets required and should specify the accommodation wanted at Albany and at Buffalo.

The rate for those who want only single tickets from New York to Buffalo will be $10, and for those who want single tickets from Albany or Schenectady to Buffalo $6.50

The committee urges all members who can do so to join the party in New York City and make the entire going trip.

Members may invite and introduce guests, either ladies or gentlemen, who will be entitled the ordinary privileges of members.

◆

Proposals Invited.

Sealed proposals will be received at the Department of the Interior until 2 P. M. August 15, and then opened, for the construction of a conduit for electric cables between the Interior Department buildings, known as the Old Post Office Department Building, and Pension Office Building, Washington, D. C., in accordance with specifications and drawings, copies of which may be obtained upon application to the Chief Clerk of the Interior Department.

PAN-AMERICAN SCENES AND EXHIBITS—IV.

BY FRANK C. PERKINS.

The Pan-American Court of Fountains as seen from the Electric Tower looking south is magnificent, as will be acknowledged by noting the accompanying illustration, Fig. 1. When the searchlight from the top of the Tower is thrown upon the various groups of statuary about the fountain basins, and upon the Triumphal Causeway, they stand out like marble with a black background. More than 100 electric projectors with focusing lamps using from 30 to 50 amperes each are in use in producing the colored water effects in the basin in the foreground of the illustration. A part of these searchlights are seen in a semicircle immediately in front of the Tower. The Temple of Music is seen at the right in the distance and the Ethnology Building at the left. In the Court of Fountains in the center are a number of circles of incandescent lamps upon the surface of the water forming the centers of flowers of various beautifully blended colors. The Mines Building, which is shown in the illustration, Fig. 2, is located on the Venetian Canal and Mirror Lake and fronts on the West Esplanade Fountain. The flower gardens are most beautifully laid out, and the statuary stands out with pleasing effect under the electrical illumination of the decorative incandescent lamps as well as the powerful rays of the Tower searchlight. The night scene, shown in Fig. 3, is a bit from the Propylæa, and gives a good idea of the soft effect upon the statuary and capitals of the columns of the electrical illumination and decorative wiring. This handsome structure is on the north side of the Electric Tower, directly in front of the Plaza.

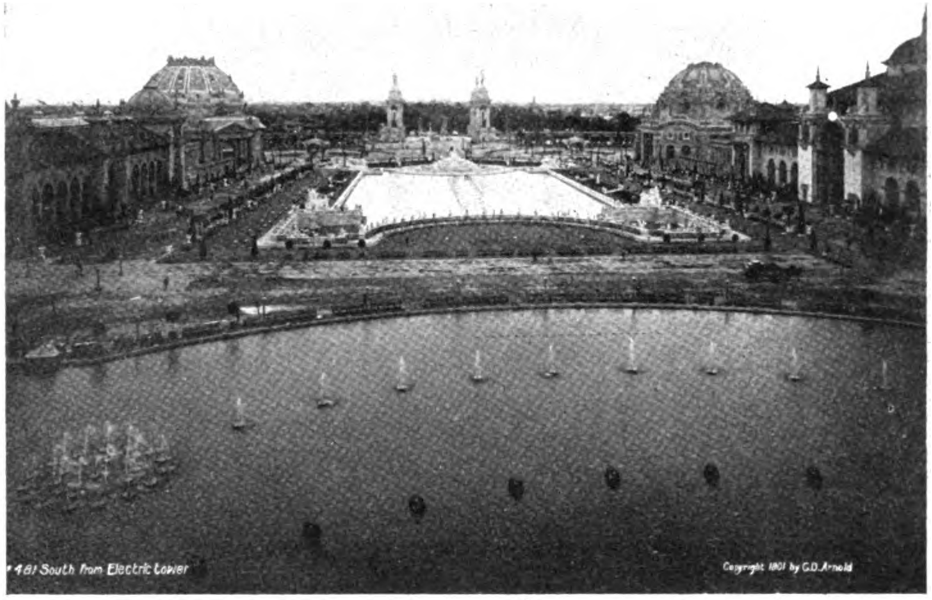

FIG. 1.
Court of Fountains looking south from the Electric Tower, Pan-American Exposition.

The next striking night scene, shown in Fig. 4, is that of the Tower looking through the archway, outlining near the base the finely designed band stands.

The Crocker-Wheeler exhibit and the booth of the Holophane Glass Company are seen in Fig. 5. They occupy a large space near the Westinghouse exhibit, west of the central part of the Electricity Building. At the back of the Crocker-Wheeler exhibit at the left is a 25 hp. semi-inclosed motor, type 25 I, operating at 91 amperes and 230 volts, the speed being 750 revolutions per minute. The 3, 5 and 7½ hp. motors in this exhibit at the left are also 230 volt machines, a solenoid brake being attached to the smaller motor. In the center is a 30 kilowatt generator, of the engine type 34 D, designed to give 240 amperes at 125 volts, operating at 300 revolutions per minute. Directly in front of this machine is a Crocker-Wheeler motor dynamo of 7½ F type, operating at 920 revolutions per minute, the current being 27 amperes and 230 volts. At the right is exhibited a small bipolar machine, a 2½ hp. mill motor, and two multipolar machines of 10 and 20 hp. each, while in the background a reversing controller is mounted, which includes a quick-break attachment and blade starter for large motor, using heavy currents, with interlocking device on the cutoff switch.

FIG. 2.—THE MINES BUILDING, PAN-AMERICAN EXPOSITION.

ALTERNATING-CURRENT POWER WORK.*

BY T. P. GAYLORD.

Polyphase generators may be divided into three general classes, depending upon the nature of their revolving element, viz:—

1st. Revolving armature generators.
2d. Revolving field generators.
3d. Induction type generators.

The induction type generator appeared severael yars ago as a kind of electrical fad, but developed so many inherent defects that it is now being abandoned. The revolving armature and revolving field generators each have their place, depending upon the class of service required. The stationary armature machine avoids the use of collector rings, which are objectionable only in case of very large current-carrying capacity generators. Somewhat better insulation can be maintained on the stationary coils, which makes this type of machine better adapted to high voltages.

The revolving armature machine, in moderate sizes, will give slightly better regulation and efficiency than the revolving field machine, due to the fact that the armature circuit is shorter, giving less current loss and less self-induction. The difference, however, between the revolving field generator and the revolving armature machine is slight.

One of the important problems met with in connection with the design and operation of polyphase generators is that of multiple operation. For simplicity and flexibility of operation it is desirable to have all the generators of one station capable of being connected together electrically and feeding into a common system of distribution. Successful multiple operation depends almost entirely upon the speed characteristics of the prime mover. Uniform angular rotation is essential, and the different engines driving generators in multiple must have a speed regulation such that they will deliver power to their respective generators (depending upon their capacity) in proportion to the total load. In case of water-wheel drives, the problem is a very simple one, and generators so driven are paralleled without difficulty. Where steam-engines are used as prime movers the responsibility at once falls upon the engine builder. It is customary for the generator builder to indicate what variation from uniform angular motion may be permitted for any given installation, and with this information the engine builder can supply proper fly-wheel capacity and governing devices necessary for the successful operation of the generators in multiple.

Generators of both the revolving field and revolving armature type are manufactured suitable for direct connection to nearly all classes of engines and water-wheels. Any desired voltage may be obtained up to 6,600, or even 12,000 volts, direct from the generator; but it is usually considered better practice, where high voltages are necessary, to generate at a nominal voltage of 1,100 or 2,200, and step-up by means of transformers. By this means the station apparatus can be better protected from lightning, as the transformer is capable of being better insulated than the windings of a generator.

Transformers, for use in connection with power transmission systems, are made in two distinct types—the oil-insulated or self cooling type, and the air-blast transformer. With the oil-insulated type no auxiliary apparatus, in the form of a blower, is necessary; but there are some installations where the storing of large quantities of oil is considered objectionable, on account of the supposed fire risk, and in such places the air-blast transformer is furnished. However, with a proper transformer oil, having a flash test of 350 degrees Fahr., there is little or no danger from fire. Such an oil is regularly upon the market, and should always be used for transformers installed within doors.

For general power purposes the alternating current, applied direct to motors, meets all requirements; but there are some special classes of work, notably street railway operation, which, for the present at least, in nearly all cases requires direct current. The induction motor, for traction purposes, has, however, recently received considerable attention. While it may not fulfill street railway conditions as well as the series direct-current motor, it would be unfair to infer that the induction motor is in any way inferior to the direct-current. In considering this question, one should not make the comparison simply between the alternating current and direct current, but rather between a motor of automatically varying field strength and one of constant field strength. The series motor, representing the first class, is particularly well suited to frequent starting and accelerating railway loads, while the direct-current shunt motor or the alternating-current induction motor, representing the second class, is not as well suited for this service. With interurban roads, where starting and accelerating is relatively infrequent, and therefore, an unimportant part of the work, the series motor may not present the same advantage over the induction motor.

In a general system of polyphase power distribution, where it is necessary to use direct current, the alternating current is transformed to direct current by means of the rotary converter. But this transforming of alternating into direct current is only one of several uses for which the converter may be employed. It may be driven mechanically and deliver either alternating or direct current, or both. In stations combining both lighting and railway work it is often installed as a connecting link between the two systems, operating either from the alternating or the direct-current generator.

Rotary converters, for delivering direct current, are usually provided with a small induction motor, mounted upon the rotary shaft, for the purpose of bringing it into synchronism with the generator feeding the circuit. They may, however, be started by opening the field circuit and throwing alternate current directly on the armature; but this method, if applied to a rotary large in comparison with the generator, results in pulling a heavy momentary load from the station. Another method of starting is by means of direct current and a starting rheostat, where a constant source of direct current can be obtained.

---

* From "Cassier's Magazine," for August.

Where rotaries are to run from direct-current and feed an alternating-current system they should be excited from a small generator, mounted on the rotary shaft, and subject to the same speed variation which takes place in the rotary. A short-circuit or a sudden overload on the alternating current side of the rotary tends to demagnetize the fields, and, consequently, increase the speed of the rotary converter. With the direct-connected exciter, the rotary magnetic field would strengthen as the speed increased, and any tendency which the rotary might have to run away would be thus obviated.

The rotary, in trying to follow the generator speed, sometimes gets into an oscillation or pendular motion relative to the generating system. This effect is generally known as "pumping," and if allowed to develop to any considerable extent, may cause serious trouble. To prevent this copper shoes are placed on the pole faces. These act as a brake to this oscillating motion, the braking action varying with the amount of oscillation. The corrective action is thus greatest with the greatest "pumping," and with a generating system which has considerable angular variation in the driving power there will be a braking or damping action at all times. This also applies to synchronous motors.

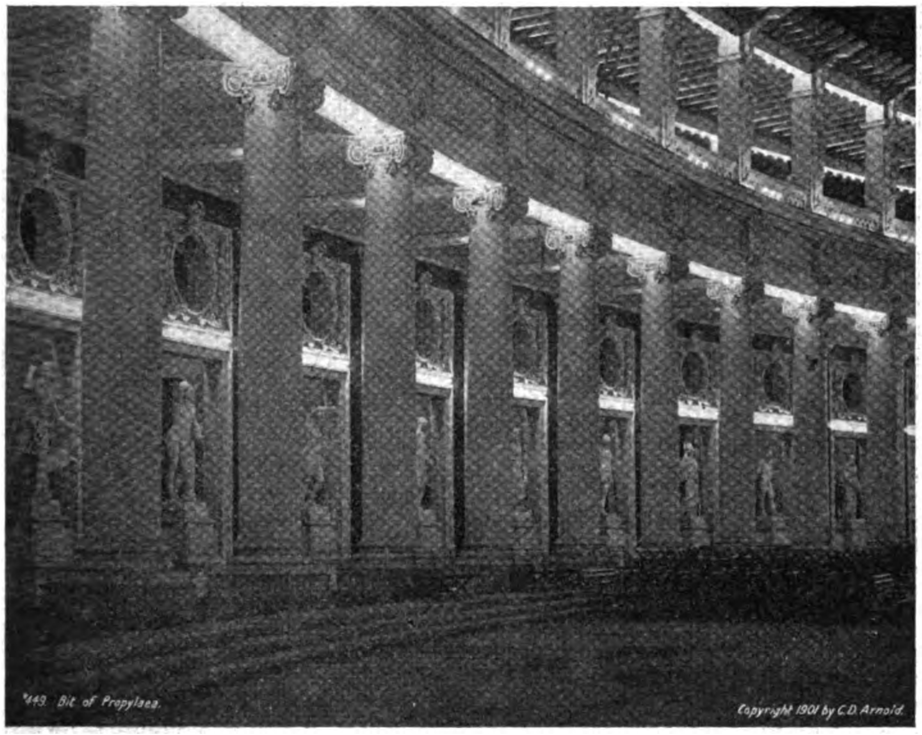

FIG. 3.
Night Scene of Bit of Propylæa, Pan-American Exposition.

One of the most attractive features of the alternating-current power system is the induction type motor. While the synchronous motor has received considerable attention and has been used with success in many cases, yet it does not meet the varied conditions of general power service. The polyphase synchronous motor can be made self-starting, but its torque at starting is very small, and it is, therefore, not suited to a great majority of installations. Its field must be excited by direct current, making usually an auxiliary piece of apparatus to accompany the motor. Furthermore, to secure the best results, the field charge should be varied as the load changes, which means constant attention under usual conditions. Its efficiency, under ideal conditions, is slightly greater than that of the induction motor, but these conditions are so seldom attained in practice that little or nothing can be gained in this respect.

The induction type motor has none of the objectionable features mentioned above. In the standard form there are no electrical connections to moving parts, and no adjustments to make. For this reason it is the most nearly "fool-proof" motor ever designed.

The starting torque of the induction motor does not differ materially from that of the direct-current motor. Within certain limits speed regulation and starting torque are factors which are diametrically opposed to each other. In the standard induction motor, two and one-half times full load torque can easily be obtained, and in the large sizes of 200 to 500 hp. capacity three and one-half to five times full load torque can be obtained without sacrificing speed regulation to any appreciable extent. In what may be termed the constant-speed motor the resistance of the secondary, or revolving element, is made as low as possible. This gives a speed curve which falls off but little from no load to full load, and brings the maximum torque at about two-thirds synchronous speed. This maximum torque is usually several times full-load torque, making the motor capable of carrying enormous overloads before breaking down, a feature which is very desirable in many classes of work.

Many who have not closely followed the development of the alternating-current power business are of the opinion that the induction motor is not suitable for variable speed work, but it may be stated positively that there are but few conditions requiring a variable speed motor that cannot be met successfully by means of an induction motor, properly designed.

There are two types of variable speed induction motors,—one in which the speed changes are accomplished by varying the voltage applied to the primary, while in the other the speed changes are made by varying the resistance of the secondary. In the first type the design and construction are similar to the standard speed motor, except that the secondary resistance is made greater, thereby bringing the maximum torque at zero speed, or, in other words, at the point of starting. In this case the speed curve falls off rapidly as the torque increases. The torque for all speeds varies approximately as the square of the voltage applied to the primary; so, by applying proper voltage, any desired torque, from zero to maximum, may be obtained.

The induction motor is not limited in the voltage of the supply current in the same way that the direct-current motor is limited. In the latter the voltage for which commutators can be constructed, and at which they can be properly operated, is a matter of the greatest importance. These considerations, of course, do not apply to the induction motor, and, if the matter of insulation be neglected, the general statement may be made that the motor can be wound for any voltage, the number of turns being increased in proportion as the voltage is increased. It is obvious, however, that the increased number of turns requires a greater amount of insulation; hence, the motor must be of larger size, and its efficiency must be necessarily somewhat reduced.

On the other hand, the voltage of the supply circuit must not be so great as to become dangerous, either to property by increasing the fire risk, or to persons. It is found that almost all cases are satisfactorily met by a voltage of either 200 or 400, and these voltages have, therefore, been made standard. A convenience also arises in the facility and interchangeability of transformers for supplying the various standard voltages of 100, 200 and 400 volts. Motors of only a few horse power cannot be advantageously wound for higher voltages. Larger motors can be readily wound for higher voltages, and motors of 40 or 50 hp. are frequently wound for 1,000 or 2,000 volts, although the construction is not as desirable as that for lower voltages.

Direct-current motors are usually wound for 110 or 220 volts for general service, and in exceptional cases, where a higher voltage is admissible, 500 volts are employed. The construction of the induction motor being more advantageous for higher voltages than those for the direct-current motor, it follows that higher voltages may be safely employed. The 200 and 400 volt induction motors are in general use where 110 or 220 volts would be employed if direct-current motors had been used. For higher voltages it will often be found that the conditions which would make 500 volts direct current allowable will permit the use of 1,000 volts for alternating-current motors. In this way a decided advantage is given to the alternating current motor in the point of economy in the conductors for supplying the current.

For power work only, the three-phase system would be selected, as it would effect a saving of 25 per cent. in line copper. Where light and power work are combined, the two-phase system would give the best results.

The question of frequency is important. If the plant contemplates both arc and incandescent lighting, combined with power, a frequency of 7,200 alternations per minute would be selected, inasmuch as arc lamps do not operate very successfully on frequencies much lower than this. Incandescent lighting can be done satisfactorily on a frequency as low as 3,600 alternations per minute, and for shop work and general outside lighting 3,000 alternations will give satisfactory results.

The number of alternating-current power installations recently made, using induction motors of both standard and variable speed types, has been large and entirely successful. The results obtained by the use of this apparatus have been gratifying, both to the manufacturer and to the purchaser, and insure a broad field for alternating-current power work.

WORKSHOP TRAINING FOR YOUNG ENGINEERS.*

BY R. D. SUMMERFIELD.

There is at the present day a tendency in some quarters to question the necessity of workshop training for engineers, and to substitute a technical college course instead. The persons who hold these views are mostly professors and teachers of science and engineering, and as the majority of them have never been through the shops themselves it is natural that they should suppose such experience to be unnecessary, especially if the student receives practical instruction in the college workshop. Students at such technical schools generally hold the same views as their teachers, as the idea of going to work at 6 o'clock every morning for three or four years and working among ordinary workmen is not one which appeals to the majority of lads. They are, therefore, quite content to tinker about in the school workshop, and when they leave endeavor to get straight into some drawing office, when they imagine themselves engineers.

Now, in the writer's opinion, to provide a workshop for a technical school is a simple waste of money; it is not only useless, but in many cases actually harmful, as the students have to unlearn much of what they were taught there when they become connected with an engineering concern. It is quite right to have laboratories, and such plant as a boiler, steam-engine, pump, dynamo, etc., on which tests for horse power, steam and fuel consumption, efficiency, etc., may be carried out by the students, as such tests are probably the most important part of the school teaching, if they are carefully carried out, and the value of the results clearly and fully pointed out by the teacher; but to fit up a workshop in imitation of an engineer's shop, and to set the students to make small engines, lathes, etc., is little less than a farce, as far as such training is of any use to them in after-life. The work turned out of these college workshops is often very well done, but it is done with no regard to time or cost; the students spend hours in filing up two or three nuts or in polishing surfaces which would be better left unpolished, etc. The consequence is that when they leave school and go into an engineering works, where economy in production is considered of the first importance, and the theoretically best form of any machine can only be approximated to for good practical reasons, they have to quickly unlearn the out-of-date method of working taught in the school workshop, and they will usually not be long in coming to the conclusion that the time spent there was, to say the least, wasted.

There can be little doubt that no matter what branch of engineering a lad intends to take up—civil, mechanical, or electrical—the best foundation he can have is four or five years' practical workshop training. Less than four years is not sufficient for a lad to really learn much, as it takes a year or more for him to get into the swing. To gain the fullest benefit from a course of workshop training, it is not enough to learn how to chip and file, to turn, make patterns and castings, and to do work as quickly as an ordinary workman. This knowledge will fit a man for a foreman's post, but if the student aspires to become a manager or chief engineer, he would be wise to spend a good deal of time when in the shops in taking notes, making sketches and finding out how much things cost to make. This is a part of his training which is rarely impressed upon him, unless his father or some near relation happens to be an engineer, and the student himself is rather apt to look down on the question of cost and economical production of work as commercial, the scientific side of engineering being all that he cares about. He will find when he leaves the shops that the commercial side is usually considered most important, and that the question of cost rules everything, and he will then regret, as the writer often has, that he did not make a better use of his time in the shops.

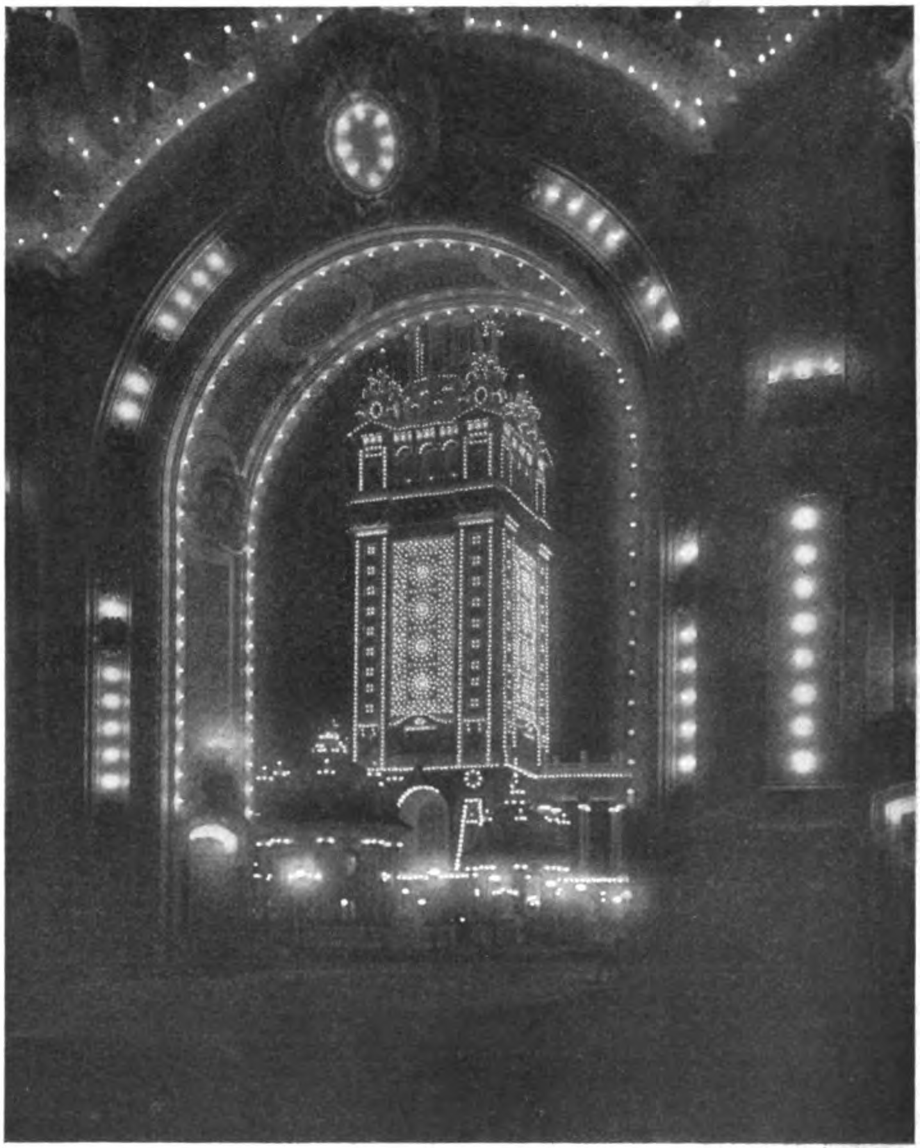

FIG. 4.
Electric Tower through Archway, Pan-American Exposition.

If the student wants to gain really valuable information, which will be of the greatest use to him in after-life, he should take careful notes of the following: the size of the shop in which he works, the number of men and boys who can work comfortably in it and the number of machine tools it will hold, also the amount of work turned out per day and week. Then he should note the time required to turn, plane, or bore a given amount of surface with different metals, and the time required to drill holes of various sizes; in fact he should try to find out the maximum output of as many different kinds of machines as he possibly can, and in order to find the cost of the work turned out by each machine he must note the class of labor required to run it—whether by boys, unskilled men, or skilled mechanics; also the amount of power taken to drive the machine, generally a difficult matter to estimate, unless each machine is driven by a separate electric motor; but at any rate it is generally possible to discover the horse power of the main engine, and when the number of machines driven by it is known, some idea of the power taken by each may be arrived at.

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*From the "Electrical Engineer," London.

Of the knowledge gained in a workshop which can be gained in no other way, not the least important is that relating to the character and peculiarities of workmen. When going through the shops, the pupil works side by side with the men, and as they usually treat him without the slightest deference he soon discovers their likes and dislikes, their real or fancied wrongs and hardships, and the best way to get on with them; and if he should be fortunate enough later on to become a manager, he would find this knowledge of great use in dealings with his men. The student would find it useful to ask himself such questions as the following: "If I were called upon to lay out a works to turn out a given quantity of engines, boilers, or machinery per week or year as economically as possibly, what data should I require to work upon?" "If I had to rearrange the driving of a factory, changing from belts and countershafting to motor driving, could I make a close estimate of the power required by various tools?" "What class of articles can be made more cheaply by turning out of the solid bar instead of being forged and then turned?" "What amount of oil is required to lubricate various tools, and what is the best lubrication when cutting different metals?" "What is the best way to treat workmen to get the most out of them, and yet keep them contented?"

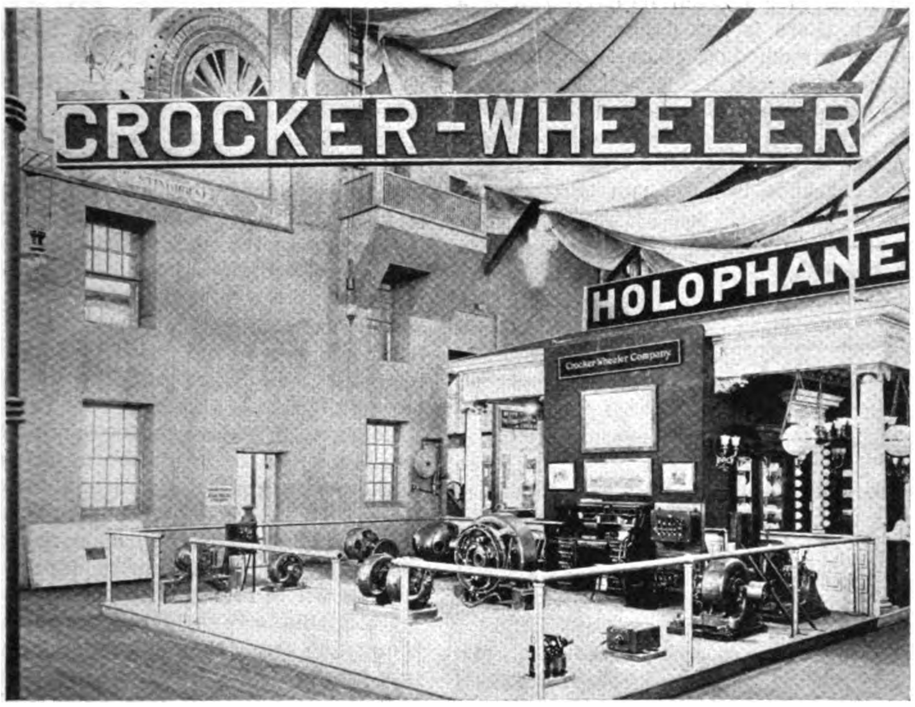

Fig. 5.

Crocker-Wheeler and Holophane Glass Company Exhibit in Electricity Building, Pan-American Exposition.

The man who has made such use of his shop training that he is ready with an answer when such questions come to him is the man who quickly rises to be a head, and in order that he may be ready, the pupil should let no detail of shop method or management escape him. Notes which at the time he may think of no importance may probably turn out to be of more use to him afterward than the skill he attained in scraping up a face plate or handling a lathe. Not that actual work should be neglected by any means. An hour a day should be enough for the student to devote to the surroundings of his work, and he can write his notes out in the evening while the subject is fresh in his mind.

A great advantage of workshop training, at any rate, from a parent's point of view, is that it enables a lad as a rule to obtain a post much sooner than if he had only been to a technical college—a post, that is, in which he earns enough to keep himself. Take the case of schools devoted more particularly to the teaching of electricity, for instance. A great number of people who know nothing about it imagine that electrical engineering is a separate profession altogether, instead of being only a branch of mechanical engineering. They think, therefore, that if their sons go through a two or three years' course at an electrical engineering college they will become electrical engineers, and command good salaries "for electricity is the coming thing." The student at such a college imagines this also—until he tries to prove it. On leaving college what does he find? Does he find employers falling over one another to secure his services? By no means. After a long and disappointing struggle he probably gets a job as a switchboard attendant at some small station, as a junior in a test office, or some similar insignificant post, and unless he is very smart his chance of rising is but small, as his want of shop experience always stands in his way.

Another advantage of a workshop course, apart from any question of experience, is the health and strength which it gives, if followed in a sensible manner. Probably the chief reason for its healthiness is the early hour at which it is necessary to rise in the morning, 5:30 or 6, but to get the benefit of this it is necessary to go to bed early, not later than 11, though an hour earlier is better; and the enthusiastic pupil who works at his books until past midnight, and yet prides himself on keeping good time at the works, will find no benefit to his health from the shops. Four or five years of steady hard work in the shops, with early hours and the avoidance of excesses, will lay a splendid foundation for a long and active life, and there are few engineers who do not look back to the time spent in the workshops as one of the happiest periods of their life.

NOTES ON THE CONSTRUCTION AND PROTECTION OF AERIAL TRANSMISSION AND DISTRIBUTION SYSTEMS.*

BY K. B. THORNTON,
Montreal.

In this country the majority of transmission and distribution systems are of overhead construction, and are likely to remain so for many a long day. As these systems are exposed to all kinds of weather it is a matter of great importance to those who are operating the same that they be constructed and protected in the best possible manner. Aerial lines are constructed by placing wooden or iron poles in the ground, generally at distances varying from 105 to 120 ft. apart in cities, and from 90 to 100 ft. apart for high voltage transmission lines in the country.

For wooden poles, cedar wood, owing to its lasting qualities, is generally used up to lengths of 50 or 55 ft.; beyond this length they are hard to get of suitable proportions, the tops being often too small and the butts too large, and the price prohibitive. Apart from this, cedar is also too brittle a wood to use for high lines. Spruce and pine poles are therefore used where lengths over 55 ft. are required, chestnut and other desirable woods not being obtainable in this country. As it is daily becoming harder to get long poles it is often necessary to resort to splicing poles to get the proper lengths.

Good cedar poles will last for twenty years and more without showing any signs of rotting but red pine poles will generally rot at the butt in cities in less than ten years, and spruce poles often show signs of rotting in four or five years, depending very much, however, on the nature of the ground in which the pole is located.

With a view to increasing the life of spruce and pine poles it is customary when placing them to coat the butts with a heavy coating of tar. The length of poles is governed by the conditions of locations. They are usually from 40 to 65 ft., and to clear high buildings, from 75 to 80 ft. Experience has shown that it is advisable to keep the lengths of the poles as short as possible, as they are less exposed to the weather, and it is generally a hard matter in cities to guy them.

Throughout residential and suburban districts and for transmission lines through the country the usual length for poles is 40 ft. The following are some of the essential features of a pole contract:

Poles to be of good, sound, well shaped line cedar wood, not less than 7 in. in diameter at the small end.

Poles to be cut square at both ends and the bark stripped off clear from the top to within 6 ft. from the butt, and all knots to be neatly trimmed off; no pole will be accepted with two curves in it.

Poles will be inspected and branded at point of shipment, the inspector having the power to reject any pole that he may consider to be unsatisfactory.

Shaving Poles.—Poles when unloaded at the pole yard are inspected and shaved, the cost of shaving averaging about ¼ cent per foot.

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*Paper read at the Eleventh Convention of the Canadian Electrical Association, Ottawa, June 19-22.

Setting Poles.—In regard to the setting of poles no regular rule can be given for the depth which they should be set in the ground; usually it is from 5 to 7 ft., depending on the height, location and the condition of the ground in which they are located.

The following are the usual depths of setting in good ground:

Height of Pole.	Depth of Setting.
35 to 45 ft.	5 ft.
50 to 55 ft.	6 ft.
60 to 80 ft.	7 ft.

In marshy or "made" ground it is often necessary to concrete the butts of poles, using a mixture composed of one part of cement, three parts of sand and five parts of broken stone.

Up to a height of 45 ft. poles are set with pike poles and a dead man, and over that height with a derrick.

The number of men being as follows:

Height of Pole.	No. of men required.
30 ft.	6 with pike poles.
40 ft.	7 with pike poles.
60 ft.	10 with derrick.
70 ft.	15 with derrick.
80 ft.	15 with derrick.

Should the poles be wet one or two additional men may be required on account of the extra weight. The gains are cut while the pole is on the ground and also when used in cities the holes drilled for spikes.

When a pole is once set the earth is well tamped round the butt; this is especially necessary in the early spring when the frost is not quite out of the ground, and if not properly attended to the poles will get out of line in a very short time.

Spikes are of square wrought iron, 9 in. x 9-16—two men being able to drive about 500 per day of ten hours, once the holes are bored.

Cross arms are usually of red or yellow pine and vary in length for ordinary city service from 2 ft. 6 in. for a two pin arm, about 8 ft. for a six pin arm, and have a sectional area of 3¼ x 4¼ in. for all ordinary work; for transmission lines the dimensions will vary from the above depending on the nature of the transmission service.

Cross arms are rounded or chamfered on the top side to prevent water gathering and lag screwed to the poles with 7 in. x ½ in. lag screws. Some prefer to fasten the cross arm with bolts passing through the poles, but our experience has been that it is easier to replace cross arms that have been lag screwed than those which have been bolted, as the bolts generally rust, making it necessary to use a drift to drive them out.

Braces.—All four and six pin arms should be braced with flat iron braces not less than 1¼ in. x ¼ x 27 in., bolted to the cross arm by 4 in. x ⅜ in. machine bolts at one end and either lag screwed to the pole with a 4 in. x ⅜ in. lag screw, or bolted to the next cross arm underneath.

On important transmission lines with long and heavy cross arms, where very strong work is required, braces of angle-iron in one piece are sometimes used.

A brace composed of one piece has some distinct advantages, for instance, some time ago one of the wires on a high voltage transmission line slipped off the insulator on to the cross arm, and the current to ground through the pole burned the cross arm clean off the pole, leaving the two outside ends of the arm supported by the brace, permitting the service to remain uninterrupted until such time as the line could be conveniently shut down.

Pins are fitted in holes drilled in the cross arms about 15 in. apart and 22 in. between the center two pins, and secured by a wire nail driven through the cross arm.

After considerable experience with oak pins they have been abandoned in favor of 1½ in. locust wood pins, it being found that oak pins after five or six years were inclined to rot and break off at the shoulder when subjected to any great strain.

Where great strength is required at corner poles or for dead ending, it is advisable to use solid iron pins.

On long straight runs it is advisable to set the cross arms in such a way that they alternately face each other on adjacent poles and are back to back on the next two poles; in this way, should a stretch be cut down or a pole break, there is less danger of the cross arms being wrenched off than if they were all set in the one direction.

At all long stretches, corners, and for dead ending, cross arms should be doubled, with a spacing block at either end of same and fastened at the ends by bolts run through the spacing blocks.

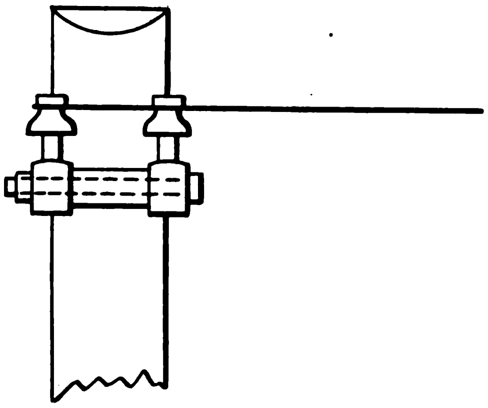

FIG. 1.

Insulators.—For regular line voltages of 2,000 to 3,000 volts, the ordinary deep grooved, double petticoat glass insulators are used; for higher voltages it is necessary to use specially prepared triple petticoat insulators of porcelain or a combination of porcelain and glass, so proportioned as to give the greatest distance between the point of support of the wire and contact with the pin and at the same time permitting of a minimum amount of surface leakage.

These insulators are ordinarily subjected to a break down test before being placed in order to locate defects.

Wire.—For all ordinary line work soft drawn copper wire is preferable to hard drawn, the disadvantages in using it due to increase of sag being more than offset by the difficulties in handling hard drawn wire and the possibilities of damaging same when it is being erected.

As yet aluminum has not come into general use for overhead construction owing to the difficulty of making proper joints and the greater size of the conductor necessary to get the equivalent conductivity of copper.

It is customary on city lines to use wire insulated with a double braid of cotton thoroughly saturated with an insulating compound.

Rubber covered wires for line work are of no use as the insulation will deteriorate in a comparatively short time, when exposed to all kinds of weather, rendering it worse than useless.

Tieing.—The line wire is secured to an insulator at each cross arm, being laid in the groove of the insulator and tied with a short length of wire about one or two gauges smaller than the line wire.

Jointing.—The ordinary twist joint is used except on very heavy wires of No. 000 gauge and over, when it is better to use a lap joint, as it runs over the cross arms easier when the wire is being strung.

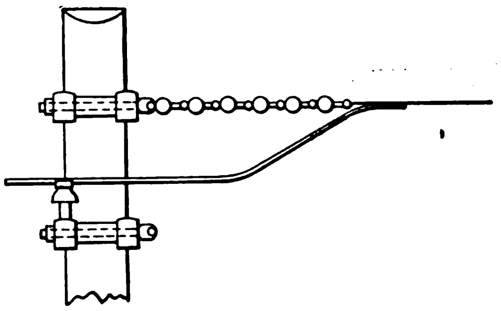

FIG. 2.

Dead Ending.—Lines are generally dead ended on double cross arms, the wire being twisted round the insulators and then back on itself, and the tie wires soldered to the line wire on the last two or three poles. (Fig. 1)

For high voltage lines, a dead ending arrangement, consisting of a series of globe strain insulators is sometimes used, the line being fastened to one end of a string of strain insulators, the other end of which is bolted through the cross arm, as shown in Fig. 2.

This system of dead ending is not altogether satisfactory as the insulation of the strain insulators deteriorates and breaks down.

Fig. 3 shows another method for dead ending high voltage lines, which has proved to be very satisfactory, although more expensive than that shown in Fig. 1.

With this arrangement the wire is tied round two insulators, supported on a special iron bracket which is bolted through the cross arm, the center of the wire being in line with the shank of the bracket.

Stringing Wire.—Wire when strung is subjected to the mechanical strains due to weight, tension, variations in temperature and additional weight in winter due to ice, and when stringing wire in our Canadian climate, special allowance must be made for variations in temperature.

Dynamometers are not ordinarily used to determine the tension of the wire strung, but experience has shown what sags to allow between poles for different sizes of wire.

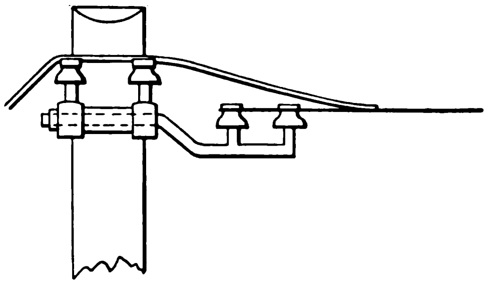

FIG. 3.

The deflection of a wire supported between two points is given by the formula:

$$d = \frac{L^2 W}{8 T}$$

Where d = Vertical deflection at middle of span.

L = Length of span.

W = Weight of wire in lbs. per ft.

T = Maximum tension of wire in lbs.

The length of wire in a span is given by the formula:

$$L_1 = \frac{L + 8 d^2}{3 L}$$

Where L_1 = length of wire and L = length of span,

$$\text{or } d = \sqrt{\frac{3 L (L_1 - L)}{8}}$$

Stresses.—Pole lines are subjected to various stresses which have all to be provided for.

These stresses are, firstly, those due to the weight of the conductors and fixtures on pole, or the weight of ice on the conductors together with their weight tending to crush the pole, and secondly, those due to the lateral pressure of the wind on the pole and conductors, tending to break the pole by bending; the action of the wind also has the tendency to break the pole near the ground due to vibration.

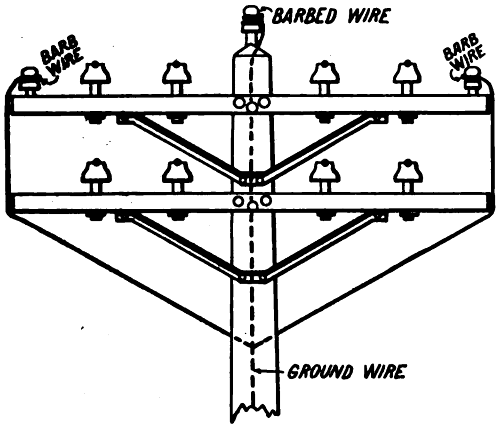

Fig. 4.

The danger due to crushing is not very great as there is always a very large factor of safety.

On one of the heaviest pole lines in Montreal the factor of safety for crushing under ordinary conditions is about 400. Once during the winter, after a very heavy sleet storm, this factor was reduced to about 240, owing to the extra weight of ice on the wires.

The stresses, however, which are most to be feared, are those caused by wind.

The same pole line mentioned was blown down in November last during a hurricane, about eighteen 70 ft. poles being broken.

McGill Observatory reports gave the velocity of the wind at 75 miles per hour, which is equivalent to a pressure of 25 lbs. per sq. ft. This represented a total pressure on each stretch of this particular line of 3,750 lbs., and there is no doubt that if this had been applied as a constant pressure that the poles and guys would have withstood same. However, the combination of the wind and the swinging of the wires evidently produced a strain in excess of the strength of the poles and guys.

Guying.—All lines require lateral support in the shape of braces or guys to withstand wind stresses, the poles themselves when loaded with wires being unable to withstand same.

In the country poles can be side braced with short wooden poles or guyed with anchor rods, but in cities this is impossible and guy wires have to be used.

Galvanized iron or stranded steel is used for guy work, the stranded steel being preferable as it is much more flexible and its weight length for length considerably less.

On long, heavy lines, poles in addition to being side guyed, should be guyed with crossed head guys every four or five stretches to prevent the line running back or the poles breaking, should any single pole in the line break or a stretch be cut or broken down.

Where there are several cross-arms on a pole the "Y" guy is most useful, and at points where circuits dead end on one side of a cross-arm "Y" guys should also be used to prevent the arms being twisted out of line.

The practice of guying to trees and buildings should be avoided in all cases, for aside from making poor anchors for guys, they are subject to removal at a minute's notice from the proprietor and the company owning them is also liable for damages.

Lightning Protection.—The protection of aerial lines from the effects of lightning storms is a matter which has received considerable attention from all central station engineers operating overhead systems.

With the advent of high tension transmission lines the difficulty of effectively protecting same has been greatly increased.

Overhead systems may be affected in the three following ways:

(1) By direct strokes.

(2) By induced discharges.

(3) By electrostatic induction.

Fortunately for electric installations, direct strokes do not frequently occur for probably no arrester would be of much service in preventing such a discharge from doing considerable damage.

Induced discharges following a lightning flash and static charges, due to surrounding atmosphere being charged, are the conditions which have to be specially provided against.

Owing to the high frequency of lightning discharges any inductance on the line offers an enormous impedance to a discharge, which fact accounts for the puncturing of transformer coils .the discharge taking the shortest and most direct path to ground.

Arresters are non-inductive resistances, usually air gaps, one side being connected to the line and the other to earth, the resistance of these gaps being low enough for the lightning to choose same for a path to ground rather than through some of the apparatus connected to the lines.

The length of the gap is governed by the working voltage of the line, the general practice of the day being to make it as small as possible without the ordinary current jumping across. However, this has the disadvantage that arresters are apt to be too sensitive and cause trouble due to dust, cobwebs and dirt accumulating, or the fusing over of the spark gaps due to repeated discharges, thereby causing a short circuit on the line or a heavy ground as the dynamo current follows the lightning discharge across the gap.

A lightning arrester, in addition to affording a short path to the ground, must also perform the duty of an arc breaking circuit to immediately interrupt the flow of the line current to ground and extinguish the arc which is formed.

Owing to the fact that any inductance in the line offers considerable resistance to the passage of a lightning discharge, choke coils are sometimes introduced in series with the line, between the arrester and the central station, the combination of arresters and choke coils forming a very reliable means of protecting the apparatus in the station. It is not a general practice to install a choke coil in conjuction with every arrester placed on the line, owing to the high cost which would be involved; however, it is a good scheme to place such a combination to protect any large and expensive apparatus connected to the circuits.

These choke coils are usually constructed of flat copper strip wound on a non-conducting core, the layers being insulated with mica or some other insulator.

Any self-induction in the way of coils or turns in the ground wire of an arrester must be avoided and when they are being put up the linemen should be watched, as it is a favorite trick to take up any slack in the wire by making a little coil; any such coils would be nothing more or less than choke coils which would completely offset the value of the arrester, rendering it virtually useless.

The ground wire is a most important feature in the installation of a lightning arrester and there is no doubt that many failures of arresters to protect lines are due to poor ground connections.

To effectively protect a circuit, arresters should be placed at the end of all lines and at points where they branch off in different directions and they should be inspected and cleaned from time to time.

Barb Wire.—Owing to the somewhat uncertain action on lightning arresters barb wire has been used on transmission lines as a protection against lightning, and the results obtained have clearly demonstrated that it is a most satisfactory means of protection.

A description of the methods adopted to protect the Chambly 12,000 volt transmission lines from lightning may be of interest as the results obtained on the two lines have been eminently satisfactory.

Two duplicate lines are run from Chambly to Montreal, the total distance being about 17 miles for each line, of which 14½ miles are aerial and 2½ miles underground cables. The underground cable is divided up in three sections, the first section being about a mile and a half from the power house, the second about fifteen miles from the power house, and the third at the Montreal end.

The country through which the lines pass is very flat and marshy towards the Montreal end. Three lines of barb wire on glass insulators are run on each pole line, as shown in Fig 4, two lines being run on the ends of the top cross arm about fifteen inches from the line wire and the third on a pin on top of the pole.

The barb wire is composed of two twisted No. 12 B.W.G. galvanized iron wires with one four point barb every five inches, and is connected at each pole by means of a soldered joint to the ground wire. This ground wire is stapled down the face of the pole and is twisted several times round the butt, after running through an iron pipe about 8 ft. long, which projects above the level of the ground, preventing the wire from being cut or broken as well as affording an additional ground.

The ground wire and pipe were stapled on the pole when the poles were being erected.

As the poles on the transmission lines are set 90 ft. apart the barb wire lines are grounded about fifty-eight times per mile; this frequent grounding being one of the most important points in the protection.

It was the intention before putting the lines into use, to place lightning arresters in addition to the barb wire, but as they were not available in time the lines were put into operation without them.

Our experience with the first series of storms showed that well grouped barb wire was a very effective protection, and the lines were therefore operated under these conditions for one entire summer.

Recently arresters of the air gap type have been installed at the power house at Richelieu as additional protection.

During one particularly severe storm the local distribution lines in Montreal and Chambly, which were not protected by barb wire, were considerably affected, while no effects were felt on the transmission lines at all, although trees were struck in its immediate neighborhood.

It was at first thought that the barb wire would rust and break down very quickly, but after two years' operation an inspection shows that it is in a very good condition, and as yet there has never been a single case of it breaking.

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Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended August 1:

Antwerp, 30 cases, $2,020; 2 crates auto vehicles, $2,000; 210 packages, $16,568; Argentine Republic, 75 cases, $7,062; Australia, 2 cases, $55; Azores, 1 case, $25; Barcelona, 93 packages, $8,221; Berlin, 27 packages, $448; Bordeaux, 54 packages, $2,487; Brazil, 46 packages, $693; British Possessions in Africa, 135 cases, $10,511; 5 packages, $172; British East Indies, 12 packages, $968; British West Indies, 11 packages, $103; Central America, 4 cases, $780; Chili, 50 packages, $1,776; Cuba, 90 cases, $2,378; Ecuador, 7 packages, $170; French West Indies, 3 cases, $11; Genoa, 12 packages, $553; Gijon, 5 packages, $73; Glasgow, 3 packages, $918; Hamburg, 17 packages, $298; Havre, 5 cases, $199; 13 packages, $337; Hong Kong, 3 packages, $326; Japan, 26 packages, $1,080; London, 330 packages, $16,004; 24 packages motor vehicles, $19,800; Liverpool, 116 packages, $7,686; Malta, 3 packages, $35; Manchester, 1 package, $200; 4 cases, $2,500; Marseilles, 20 cases, $706; Mexico, 129 packages, $2,558; Milan, 3 packages, $169; Naples, 4 packages, $366; New Castle, 47 cases, $5,900; Newfoundland, 13 packages, $229; Nova Scotia, 2 packages, $25; Peru, 12 packages, $690; Philippines, 3 packages, $108; Santo Domingo, 30 packages, $30; Southampton, 8 packages, $316; St. Petersburg, 2 cases, $200; Trieste, 11 cases, $754; U. S. Colombia, 10 packages, $81; Venezuela, 31 packages, $317; Vienna, 2 cases, $144.

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COMING ELECTRICAL EVENTS

American Institute of Electrical Engineers—General Meeting, Buffalo, N. Y., August 20-24.

American Street Railway Association—Convention, New York City, October 9, 10 and 11.

American Electro-Therapeutic Association—Buffalo, N. Y., September 24, 25 and 26.

Association of the Edison Illuminating Companies—Meeting, September 10.

International Association of Municipal Electricians—Convention, Niagara Falls, September 2, 3 and 4.

Ohio Electric Light Association—Convention, Put-in-Bay, August 20, 21 and 22.

Old-Time Telegraphers' Association and U. S. Military Telegraph Corps—Convention, Montreal, September 11, 12 and 13.

Pennsylvania State Street Railway Association—Convention, York, Pa., September 4.

Roentgen Society of the United States—Meeting, Buffalo, N. Y., September 10 and 11.

500 kw. Generators Driven by Gas Engines.

The Sprague Electric Company has recently closed an interesting order for three Lundell split-pole 500 kw. engine type generators, with speed of 100 r.p.m., and wound for 250 volts, to be direct connected to gas engines.

These three generators of 500 kw. capacity each will be installed in the new works of the Lackawanna Iron and Steel Company, at Buffalo, and are designed for a continuous overload of 25 per cent. at a high efficiency.

The gas engines will utilize as fuel waste gas from the coke ovens of the Lackawanna Company.

These will probably be much the largest generators in this country ever operated by direct connected gas engines, and the method of utilizing waste gases for such large amounts of power has never before been attempted in the United States.

The Sprague Electric Company has been very successful with the split-pole machines, as the ingenious design, high efficiency and remarkable endurance give them the best possible commercial value.

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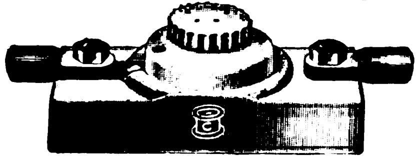
The New Goodman Fuse Plug and Base.

The electrical trade, especially those purchasing and using individual cutout blocks and fuses, is doubtless by this time familiar with the report issued by the special committee of the Underwriters' National Electrical Association at Boston, Mass., April 30, on standard switches and fuse blocks.

For the benefit of those not familiar with the office of this special committee it should be explained that at the annual meeting of the Underwriters' National Electrical Association, held in November, 1900, the above mentioned committee was appointed to develop specifications for individual cutout blocks and fuses. This action was due to the fact that cutout blocks which are decidedly unsafe are still being used in large quantities in some sections of the country.

Without attempting in any way to criticize the goods of other manufacturers, it will be of interest to those anxious to conform with the Underwriters' suggestions to know that W. R. Goodman, manager of the Chicago Fuse Wire & Mfg. Company, has designed a new type of fuse plug and base of the advanced type and strictly in accordance with the suggested specifications recommended by the above mentioned special committee of the Underwriters.

The accompanying illustration shows the general appearance of the Goodman plug and base, which are made from the finest grade of porcelain. The mountings are of the latest approved type and very substantial. This new device is made in sizes suitable for currents of from 10 amperes to 100 amperes on circuits operated at 125 and 250 volts.



For 125 volts the plug is fused with the ordinary fuse wire of correct carrying capacity. For 250 volts a specially made fuse is used, fitting the same plug, which combines the advantages of the best inclosed fuses besides being placed in a strong porcelain receptacle.

The Goodman plug and block carrying 100 amperes at 250 volts measures only 6 inches in length and 2½ inches in width.

A "telltale" button projects through the plug which indicates positively whether or not the fuse has blown. This is a mechanical feature and does not expose any electrically connected parts.

The Goodman fuse plug and block is protected by patent applications, which cover the high potential fuse and all important features of the entire system, including the "telltale" device.

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INCORPORATIONS.

The Consolidated Electric Light, Heat & Power Company, Poughkeepsie, N. Y. Capital stock, $200,000. Directors: James W. Hinkley, P. Frost Spaulding, Silas Hinkley and John Doheny, Poughkeepsie; William K. Roy, Wappinger's Falls.

The Tibbe Electric Company, Washington, Mo. Capital stock, $40,000. Incorporators: Anton A. Tibbe, Henry D. Hibbeler and Hugh J. Minhinnick.

The Electrical Vitazone Therapeutic Company, Brooklyn, N. Y.—to cure human ailments by electricity. Capital stock, $100,000. Directors: Thomas W. Tonham, Lissa M. Barnett and Stockton R. Ferris of Brooklyn.

The Wagner-Bullock Electric Company, San Francisco, Cal. Capital stock, $200,000. Directors: S. J. Hendy, E. H. Abadie, F. J. Behneman, W. P. Hassell and E. B. Young.

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ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 30, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

679,314. Electric Railway. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Oct. 19, 1897.

679,316. Electric-Switch Shell. Harvey Hubbell, Bridgeport, Conn. Filed Jan. 28, 1901.

679,331. Electric-Railway System. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Feb. 28, 1901.

679,332. Surface-Contact Railway. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 9, 1899.

679,492. Trolley for Electric Cars. John H. Beckert, St. Louis, Mo. Filed Sept. 28, 1900.

679,615. Underground Electric Conductor for Street Railways. John Floyd, Philadelphia, Pa. Filed Nov. 21, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

679,607. Support and Take-up Device for Cable-Suspended Electric Lamps. John H. Dorion, Springfield, Mass. Filed Dec. 28, 1900.

679,700. Electric-Arc Lamp. Svend M. Meyer, Brooklyn, N. Y., assignor of one-half to Thomas A. Cayton, same place. Filed Oct. 10, 1900.

ELECTRICAL MACHINERY AND APPARATUS.

679,304. Electric Meter. Walter C. Fish, Lynn, Mass., assignor to the General Electric Company of New York. Filed May 21, 1901.

679,321. Automatic Switch. Frederick Mackintosh, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed May 1, 1899.

679 333. Electric Meter. William H. Pratt, Lynn, Mass., assignor to the General Electric Company of New York. Filed April 22, 1901.

679,356. Worm-Gearing. Norman C. Bassett, Lynn, Mass., assignor to the General Electric Company of New York. Filed Oct. 26, 1900.

679,362. Electric Brake. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed July 17, 1897.

679,446. Automatic Circuit-Closer. George A. Wall, Providence, R. I. Filed Dec. 7, 1900.

679,472. Multirate Meter Frank P. Cox and Charles E. Holmes, Lynn, Mass., assignors to the General Electric Company of New York. Filed Dec. 4, 1899.

679,518. Electrical Stop for Engines. John F. Skirrow, East Orange, N. J. Filed Dec. 14, 1900,

679,521. Wire-Insulating Machine. Chester H. Thordarson, Chicago, Ill. Filed Oct. 12, 1900.

TELEPHONES AND TELEPHONE APPARATUS.

679,405. Microtelephone. Emil Volkers, Berlin, Germany. Filed March 22, 1901.

MISCELLANEOUS.

679,308. Insulator. Henry Geisenhoner, Schenectady, N.Y., assignor to the General Electric Company of New York. Filed May 1, 1901.

679,310. Signal System. John L. Hall, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Feb. 16, 1899.

679,357. Apparatus for Treating Metals by Electrolysis. Anson G. Betts, Upper Troy, N. Y. Filed March 18, 1901.

679,365. Power-Transmitting Mechanism. Rolla R. Darling, Cleveland, O., assignor to the Beardsley & Hubbs Manufacturing Company, Mansfield, O. Filed Jan. 6, 1900.

679,467. Phonograph Reproducer and Recorder. Charles W. Noyes, Cincinnati, O., assignor of one-half to Ilsen & Company, same place. Filed March 21, 1901.

679,476. Electrolyzing and Washing Apparatus. John F. Kelly, Pittsfield, Mass. Filed Sept. 14, 1900.

679,477, Electrolytic Decomposing-Cell. Josiah W. Kynaston, Liverpool, Eng. Filed Feb. 1, 1899.

679,544. Insulator for Electric Wires. John E. Sharpe, Oneida, N. Y., assignor of one-half to Newton D. Bartle, Guilford, N. Y. Filed May 17, 1901.

679,546. Secondary Electric Clock. Theodore H. Wurmb and Robert Baumann, St. Louis, Mo. Filed Jan. 26, 1900. Renewed May 2, 1901.

679,651. Electrical Ignition Apparatus. Ansbert E. Vorreiter, Aix-la-Chapelle, Germany. Filed Aug. 30, 1899.

REISSUE.

11,924. Electric Hose Signal System. Howard Sargent, Boston, Mass., assignor to the Boston Electric Hose Signal Company, same place. Filed Jan. 7, 1901. Original No. 621,854, dated March 28, 1899.

THE TELEPHONE WORLD.

Promising Results of the Canvass by People's Telephone Company.

When the People's Telephone Company started to get subscriptions for a system in Detroit, Mich., it was announced that no charge would be made for service until the new exchange had at least 3,500 subscribers. Although the exchange will not be completed until next year, the company has already about that number of telephone contracts. The prospects now are that the company will begin business with not much less than 5,000 subscribers. At Jackson the company has already secured 949 subscribers for the plant.

The Central Union Telephone Company has about completed the putting in of an exchange, and 80 private telephones in Southport and the vicinity. Both companies were after the privilege. The Central Union made a proposition to give the Southport, Ind., people telephone service for $1.50 a month, if they would put up the poles and the wire, or $2 a month, the company to furnish the whole equipment. After several meetings the latter proposition was accepted, and the people are glad they chose it, for the poles are the highest and largest in use, and the other equipment first-class. The patrons have free connection with Indianapolis 'phones or with any in the county.

Harris Fletcher and R. H. Hawkins, representives of the Overton Telephone Company, were recently in Lafayette, Tenn., and met the stockholdors of the Union Telephone Company, and it is learned that a general contract for exchange of business was entered into. The Union Telephone Company covers considerable territory, having lines in Macon, Sumner and Trousdale Counties, while the Overton Telephone Company is actively operating in Overton, Pickett, Putnam, White, Jackson and Macon Counties. Many new points can now be reached by telephone.

The Plattsmouth Independent Telephone Company has a force of linemen at work stringing another copper metallic circuit from Plattsmouth to Louisville, Neb., and a large number of 'phones will be put in farm residences along the line. The company is also building a toll line from Greenwood to Havelock, and in the near future will string two copper wires to La Platte.

The Nebraska Telephone Company of Papillion, Neb., lately began to string wire to supply 25 local telephones. It was promptly enjoined by the local company, headed by J. D. Clarke. The matter will now have to be passed upon by the district court to see which company has the right to put in the local instruments.

The Northwestern Telephone Company has commenced excavating preparatory to the erection of a two-story building at Grand Forks, N. D. A crew of men has also been put to work tearing up the paving and digging a trench for conduits for an underground service. The company will expend upwards of $25,000 before the ground freezes.

As soon as the cable across Newark Bay to Greenville N. J., is laid, the new special telephone line of the New York & New Jersey Telephone Company between New York and Philadelphia will be put in operation. The work of laying the cable is being hurried, so a direct connection can be had with Philadelphia as quickly as possible.

A company has been organized in Vernon, Tex., to build a telephone line from that place to Quanah and Crowell, Tex., and Altus and Enid, Okla. Work will be begun at once.

The new telephone line between Tyndall and Tabor and Bon Homme, S. D, is completed. Bon Homme will be much benefited, owing to the fact that the town is off the railroad.

The Missaukee Telephone Company is putting in an exchange at McBain, Mich., and it is proposed to take in a number of farmers and smaller villages near by.

Manager Elias of the Hudson River Telephone Company is making many changes and improvements in the local telephone service at Kingston, N. Y.

The Beard Telephone Company is constructing a first-class all metallic telephone system between Denison and Sapulpa, Tex., connecting all intermediate points.

Permission has been granted the Henderson, N. C., Telephone Company to maintain and operate lines along the public roads of Vance County.

Deerlodge and Wartburg, Tenn., have been connected by telephone.

Improving Telephone Systems.

The rebuilding of the telephone systems of Jacksonville, Fla., which were damaged by a recent fire, is being rapidly accomplished. The forces of linemen of both systems have been largely increased, and the construction gangs are making rapid progress in stringing wires and erecting poles, etc. The Jacksonville Telephone Company, which suffered more than the Bell, has its linemen now at work stringing 4,000 feet of wire cables. The temporary exchange, which was established in Springfield, is now being brought in, the wires all being concentrated at the central office. The Jacksonville Telephone Company expects to string 10,000 more feet of wire, which will connect up the whole city.

The Southern Bell Company is also active in telephone construction, and its efforts in improving its system are not relaxed.

There has been inquiry lately as to what progress is being made by the Peninsular Telephone Company, which had it in prospect to run a through telephone system from Tampa to Jacksonville, tapping intermediate towns. Work has progressed steadily on the system, and a considerable distance has already been covered. The line starts at Tampa, and the point now reached is Palatka. It will only be a few more months before the line is completed to Jacksonville. Communication will then be established between Tampa, Lakeland, all of the Manatee section, Bartow, Kissimmee, Orlando, Leesburg, Ocala, Palatka, and from there right through to Jacksonville. It can readily be seen what results will follow from the big enterprise.

Bell Company's Capital Reduced.

The International Bell Telephone Company reduced its capital stock on August 1 from $750,000 to $500,000 by cutting down the par value of its shares from $75 to $50.

The Central Telephone Exchange of the Sunset Telephone & Telegraph Company of Tacoma, Wash., has been moved to its new quarters in the new telephone building. The terminal room for all the lines is located on the first floor, and from this one room 4,000 wires ramify to every portion of the city. There are 11 different underground cables in view, and each carry from 300 to 400 wires. On the same floor is located the room for the storage batteries and the motor. There are 75 of these batteries with 150 ampere capacity to each cell. The general operating room is a large airy compartment located on the third floor.

The business of the local exchange of the Southern New England Telephone Company at New London, Conn., has increased to such a degree that, notwithstanding a new and enlarged switchboard was put in less than two years ago, in order to accommodate the increased patronage, the company decided to put in another that would meet all the requirements for many years to come. The equipment department of the company has been working hard to establish the new board on the third floor of the Neptune Building and has now completed the work. Speaking of the interior it may be of interest to say that it contains 10 miles of wire, 300 of the wires in use having 15,000 soldered connections.

Connection was recently opened up by the Howard Telephone Company between Ellicott City and Woodstock, Md., in the third district. This is the second rural station to which the line has been completed in Howard County, the other being Jonestown, in the second district. Efforts are being made to push the line as rapidly as possible to the other important points throughout the county; many of the poles have already been planted along the different routes. A. L. Rutledge, is in charge of the construction work, and the rapid progress made in the lines is due to his energy and activity.

From Cincinnati, O., comes the report that Philip Fitzsimmons by Probate Court declaration recently announced that he has conveyed to the Fitzsimmons Telephone Manufacturing Company all his right to use the streets and alleys of the city for telephone purposes.

A plan is on foot to organize a stock company to build a telephone line from Rhinelander to Eagle River, Wis., taking in Robbins and Three Lakes. Enough stock to build the line has already been subscribed. After the line is on a good paying basis it is the intention to build on to Tomahawk.

The Diamond State Telephone Company is pushing the extension of its line from Port Deposit, through Rowlandsville, Liberty Grove and Colora to Rising Sun, Md.

The Sunset Telephone Company has purchased the local system of the Petaluma, Cal., Home Telephone Company and will hereafter run an extended system to Petaluma.

Rival Telephone Concerns.

Three telephone companies are contesting for the privilege of running their wires through the borough of Jenkintown, Pa. For several years the Delaware & Atlantic Company has had the field to itself, but now the Standard and the Keystone Companies seek entrance. The Delaware & Atlantic Company, it appears, never secured permission to enter the town, and late in June a preliminary injunction was granted restraining the company from stretching any new lines or placing any more telephones in the town. The injunction proceedings have been postponed until September and meanwhile an ordinance was read in councils giving the company permission to install instruments. Another ordinance grants the same permission to the Keystone Company. Both measures have passed first reading.

To Start War on Bell Telephones.

H. H. Heath, of Neillsville, Wis., representing the Badger State Telephone Company, said a short time ago that his company had purchased the telephone line between Medford and Marshfield. The company will perfect the line between the two places and make it part of the system. This will enable Medford to communicate with Marshfield, Wausau, Black River Falls and La Crosse. At a recent telephone convention held in La Crosse, plans were outlined for buying up a number of small lines about the State, and consolidating them with various independent telephone companies, with the intention of getting a direct toll service to all parts of the State. This is the initial act of the war declared by the independent people on the Bell system.

Col. C. E. McClure, manager of the Richmond, Va., Telephone Company, is busily engaged upon the plans and specifications for a "Central Energy" switchboard, to be made by the Kellogg Company of Chicago, and installed at the earliest possible moment. All the 'phones now in use will be superseded by others, which will operate upon the principle that the removal of the receiver from the hook immediately establishes connection with central without ringing. Switchboard and 'phones together will mean an outlay of at least $35,000.

According to a report from Chattanooga, Tenn., the Cumberland Telephone & Telegraph Company has issued a statement of its business for the month of June, 1901. Increase in subscribers is shown as follows: Total number of subscribers June 1, 1901, 65,691; number added during June, 2,958; net increase in June, 1,069. Total number in system June 30, 66,760.

The Gainesboro Telephone Company, with headquarters at Sparta Tenn., has installed a multiple switchboard which will accommodate 1,500 drops. Two operators, one for the city exchange and the other for toll lines, will be in charge of this board. The business of this line is increasing rapidly.

The Consolidated Telephone Company awarded the contract for laying the conduits and underground wires to I. J. Lerch. They will cover five miles in the center of Reading, Pa. The overhead wires will be strung by the company. Reading, it is said, is to be the headquarters for the new company.

The special meeting of the Chicago Telephone Company has been postponed to August 16, the date originally fixed being July 31. The meeting will be held to devise means for the improvement of the service and for considering the fight begun by the Illinois Manufacturers' Association.

Business has increased with the Missouri & Kansas Telephone Company to such an extent that a new line between Wichita and Kansas City is being built. The line will be direct, and will do away with many inconveniences now in existence.

The new telephone company in Peoria, Ill., is obtaining many new subscribers.

Telephone Companies Increase Stock.

The Monticello Telephone Company, Monticello, Ind., from $5,000 to $30,000.

The Illinois Telephone Company, Bluffs, Ill., from $25,000 to $100,000.

TELEPHONE INCORPORATIONS.

The Parker Telephone Company, Parker, Ind. Capital stock, $2,500.

The Jackson & Hazard Telephone Company, Frankfort, Ky. Capital stock, $2,025.

The South Howard & Kanaka Telephone Company, Kanaka, N. Y. Capital stock, $220. Directors: Edward Stewart, Frank Conine and J. C. Barton, Bath.

GENERAL ELECTRICAL NEWS.

Lighting.

Altamont, Ill.—At the last meeting of the city council that body passed its appropriation bill, and among other things there was an item of $14,000 for an electric light plant, and $2,000 to secure its operation.

Baldwinsville, N. Y.—The electric light station, owned by J. C. Miller, was damaged to the amount of several hundred dollars by a recent fire.

Casselton, N. D.—Casselton will bond itself for the construction of a municipal electric light plant.

Cedarburg, Wis.—The streets of Cedarburg will be illuminated by electricity, and the city will assume a progressive and up-to-date aspect.

Chadwick, Ill.—The village board has decided to put in an electric light plant, new water works machinery, and additional water mains.

Farmersville, Tex.—H. L. Carver, H. D. Honaker and L. E. Bumpass are interested in the newly formed Farmersville Electric Light Company, capitalized at $15,000.

Florence, Col.—The local manager of the Arkansas Valley Electric Company announces that the concern will at once spend $5,000 in improving the local plant by adding machinery and rebuilding the works.

Franklin, Va.—J. R. Knight of this city wants to correspond with manufacturers of electric light and waterworks machinery.

Gallatin, Tenn.—The Gallatin Gas Company, one of the oldest business interests in Sumner County, has suspended operation. This was due to the successful operation of the electric light plant.

Glen Cove, N. Y.—Alexander C. Humphreys has offered to erect a new pulpit and put in new electric light fixtures in St. Paul's Episcopal Church, and the vestry has gratefully accepted the offer.

Hanover, Conn.—The management of the Airlie mills has decided to install an electric light plant at the mills which will be complete in every detail.

Horseheads, N. Y.—At the next meeting of the board of village trustees, W. W. Cole, manager of the Elmira, Water, Light & Railroad Company, expects to present a proposition to light the streets with electricity as well as to furnish light and power to private individuals.

Mount Pleasant, Tex.—The plant of the Mount Pleasant Electric Light Company was totally destroyed by fire a short time ago. The loss is about $6,000.

Newton Falls, O.—The citizens of this place have voted to adopt electric street lighting.

Norfolk, Va.—The Norfolk Railway & Light Company contemplates extending its lighting facilities to Lambert's Point.

Norfolk, Neb.—The citizens will soon vote on a proposition to bond the city for $16,500 to install a municipal electric lighting plant.

Petaluma, Cal.—The California Central Gas, Electric Light & Power Company is buying up a number of lighting plants in Sonoma and Marin Counties.

Red Lion, Pa.—At a recent election the stockholders of the electric light company voted to increase the capital stock from $8,000 to $20,000. Work on the plant is being pushed vigorously.

Starke, Fla.—This city will install a complete system of waterworks and electric lights. Collier & Brown, engineers, Atlanta, Ga.; E. P. Duncan, city attorney.

Washington, Ia.—The citizens of this place will vote on the question of a municipal electric light plant.

West Superior, Wis.—The fact that the electric lighting contract in this city expires on August 31 has revived talk in regard to the erection of a municipal lighting plant.

Street Railways.

Altoona, Pa.—The finance committee of city councils has approved the Belt line trolley ordinance. This means three-cent fares for workingmen. The new company will gridiron the city. It is backed by State Assemblyman Edward Gamble and others.

Asheville, N. C.—The work of constructing the electric railroad between here and Weaverville has begun and it is to be completed as soon as possible. L. B. Wilford of this city is one of the promoters.

Berlin, Wis.—Capitalists and engineers are looking over the ground between here and New London with the idea of building an electric line to connect the two cities.

Chattanooga, Tenn.—The Chattanooga Electric Railway Company has given a deed of trust to the Chattanooga Savings Bank to secure a bond issue to the extent of $375,000. It is stated that a portion of the issue will be used to finance the extension to Sherman Heights, which is to be built immediately.

Cincinnati, O.—The Cincinnati Traction Company is planning to put its feed wires under ground so that there will be no danger of traffic being interrupted in case of a big fire. The work will practically free the city from overhead wires with the exception of the trolley wires.

Clyde, N. Y.—The board of village trustees has granted a franchise to the Clyde Electric Power & Railroad Company to construct, maintain and operate a street surface railway using electricity as a motive power.

Council Bluffs, Ia.—It is now believed that the electric line from Des Moines to this city by way of Creston will be built next spring.

Dallas, Tex.—The Dallas Consolidated Electric Street Railway Company has filed an amendment to its charter increasing its capital stock from $1,000,000 to $2,000,000.

Elkhorn, Wis.—At a recent mass meeting the citizens declared almost unanimously in favor of the proposed electric road connecting Janesville, Delavan, Elkhorn and Lake Geneva.

Herkimer, N. Y.—The Mohawk Valley Traction Company has been incorporated to operate an electric road from Little Falls to this place. The capital stock is $80,000. Timothy Dasey, J. Judson Gilbert, Fred C. Teall, James D. Feeter and Myron G. Browner, of Little Falls; Henry Churchill, I. B. Devendorf and Henry G. Munger, of Herkimer, and J. D. Smith, of New York, are the directors.

Lancaster, Pa.—The State Department has granted a charter to the Lancaster & York Furnace Street Railway Company, to construct a trolley line from Millersville to York Furnace.

Lansing, Mich.—Articles of incorporation of the West Michigan Traction Company, organized with $1,000,000 capital, were filed with the Secretary of State last week. The company proposes to build an electric line from the vicinity of Benton Harbor to Dowagiac, Cassopolis, Decatur, Paw Paw and Kalamazoo, a distance of 90 miles. The incorporators are Eastern capitalists.

Moorestown, N. J.—It is said that New York capitalists are making inquiries as to the feasibility of building a trolley road between here and Riverside.

New Cumberland, Pa.—A trolley line will be built between here and Lewisberry, York County.

Oakland, Cal.—W. G. Henshaw, president of the Union Savings Bank, has secured a controlling interest in the Oakland, San Leandro & Haywards Electric Road.

Richmond, Va.—It is reported that the Richmond Passenger & Power Company will construct several miles of additional track in this city to form a loop through a portion of the suburbs.

Sharpsville, Pa.—Now that Pennsylvania is in control of the Sharpsville Railroad, which extends from New Wilmington junction in Lawrence County to this place in Mercer County, there is some talk of making that road an electric line and establishing a line of trolley cars.

St. Paul, Minn.—Samuel Hill has announced that he will build an electric line of railway, paralleling the present road between this city and Minneapolis, and that he will reduce the fare to 5 cents. The present fare is 10 cents.

Utica, N. Y.—The syndicate that bought all the street railroads in this city, and is extending double tracks east to Little Falls and west to Rome, has purchased the franchises and property of the street railway in Oneida. A trolley line will be built from this city to Oneida, practically parallel to the West Shore Railroad.

Walla Walla, Wash.—O. R. Ballou and a number of parties associated with him contemplate the construction of an electric railway connecting this city with Milton and other Oregon points.

Manufacturing.

Camden, N. J.—The Keystone & Electric Manufacturing Company, capitalized with $250,000, has lately filed articles of incorporation in this city.

Chicago.—The La Salle Electric Company of this city, capitalized at $9,000, has been formed for the purpose of manufacturing and dealing in electrical supplies. P. L. Biggins, L. J. Gamwell and E. M. Hanes hold an interest in the concern.

Hopewell, N. J.—The Smith Novelty Company, recently located here, manufacture metal novelties, special clock movements, water, gas and electric meter registers.

Syracuse, N. Y.—The Onondaga Dynamo Company is running the plant to its full capacity and orders are still coming in. A number of orders were lately received for electrical apparatus from different sections of the country.

Company Matters.

Amsterdam, N. Y.—There is reported a possibility that the plant of the Magneto Electric Company, a concern which expects to employ 1,000 hands, may be located here. The company is capitalized at $1,000,000. Its patents are the invention of L. G. Woolley, and the principal features of his system is the entire absence of batteries.

Bridgeport, Conn.—The evidence of growth in the Coles Electric Express Company is a new car thoroughly modern in its electrical equipment, having a capacity of at least 15 tons, and was designed and built to accommodate the increase in the business of the company.

Colorado Springs, Col.—The Colorado Electric Power Company, of which Mr. D. V. Donaldson of this city is president, has just acquired the electric lighting system of Canon City.

Hamilton, Ont.—The Electric Supply Company of this place has been made a limited liability company, with a capital of $30,000.

Manchester, N. H.—The Rockingham Power & Light Company has notified the Secretary of State of an increase in the capital stock. The figure is now $75,000.

New York City.—Henry B. Palmer and Charles A. Olsen (Palmer & Olsen), electrical contractors of 210 Centre street, made an assignment last week to James Lane.

Power and Transmission.

Eugene, Ore.—The Lucky Boy Mining Company will begin work at once on its electric power plant on Blue River. It will install a plant costing nearly $30,000, and will not only supply power to operate the mill and other machinery of its mine, but will also sell power to other operators. Abundant power will be secured by damming the river. The electricity will be transmitted from this point three and one-half miles up the mountain to the Lucky Boy mine.

Joliet, Ill.—A proposition to install electric power at the waterworks for pumping purposes is being seriously considered, and the claim made for the change is that it will greatly reduce the cost of operation as well as be much easier to operate.

Peterboro, Ont.—Peterboro manufacturers have leased Dam No. 5 in the Trent Valley Canal for the purpose of generating electric power, and have offered to supply surplus power at $15 per horse power per year for a day of 12 hours.

Raleigh, N. C.—The Raleigh Ice & Electric Company is making rapid progress now on its electric power plant at Milburnie, six miles north of here, and it will probably be completed within the next three months.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Albany, N Y.– Aug 5						
United Traction (Consolidation of the Albany and Troy City Railway.)	100	$5,000,000	$5,000,000	1¼ % Q.,	104	105
Allentown Pa.– Aug 5						
Allentown & Lehigh Val. Trac. Co.	....	4,000,000	1,500,000	....	--	15
Bridgeport, Conn–Aug 5:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug.,	100	...
Baltimore Md.–Aug 5						
a United Rail ways & Elec. Co...com	50	24,000,000	18,000,000	....	16	16⅛
Boston, Mass.– Aug 5						
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan.15,	...	--
North Shore Traction Co........com.	100	4,000,000	4,000,000	....	15	16
North Shore Traction Co........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	85	87
b West End Street Ry. Co.......com.	50	10,000,000	9,085.00	8½ % S., Oct.,	95	95¼
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Jan.	110	1.0⅛
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 99,	186	187
Brooklyn N. Y.– Aug 5;						
Brooklyn City Ry	100	2,000,000	1,928,400	....	241	245
Brooklyn Rap. Transit Co., tr certf..	100	48,000,000	48,000,000	....	73	73¼
*c*Brooklyn Heights Railroad	....	200,000	200,000	....	107	109
**d*Brooklyn City RR.........guar	100	12,000,000	12,000,000	3½ % Q., Jan.,	237	239
*e*Brooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	--	--
Coney Island & Brooklyn RR.	100	2,000,000	1,884.200	2½ % Nov.,	325	330
Kings County Elevated	....	4,750,000	4,750,000	....	--	...
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July	--	--
Nassau Electric Railroad ....pfd.	......	6,000,000	6,000,000	....	82	83
*f*Atlantic Avenue Railroad	50	2,000,000	2,000,000	....	--	--
*g*Brooklyn, B. & W. E. Railroad..	....	1,000,000	1,000,000	....	--	--
Buffalo N. Y.– Aug 5:						
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	....	74	75
*Buffalo Railway Co.	100	6,000,000	5,870,500	1 % Q. Dec.	99	100
Columbus O.–Aug 5						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Feb.	38	39
Columbus Street Railroad, pfd....	100	1,500,000	1,500,000	....	100	102
Charleston, S. C.– Aug 5						
Charleston City Ry. Co.	50	100,000	100,000	8 % S.	--	--
Enterprise City RR. Co.	25	1,000,000	250,000	....	--	--
Chicago, Ill.– Aug 5						
Chicago City Ry. Co.	100	12,000,000	12,000,000	8 % Q., Dec. 31,	250	260
Chicago & South Side R. T. RR.....	100	10,328,800	10,328,800	....	--	--
Lake Street Elevated RR.	100	10,000,000	10,000,000	....	13¾	14
Metropolitan West Side Elev. Ry...	100	15,000,000	7,000,000	Feb 28 1900.	36½	36¾
Met. West Side El., pfd	100	15,000,000	9,000,000	....	89	90
North Chicago Street RR.	100	10,000,000	6,600,000	8 % Q., Jan.	209	210
*h*North Chicago City RR.	100	500,000	249,900	....	200	201
South Chicago City Railway	100	2,000,000	1,608,200	....	108	109
West Chicago St. RR. Co.	100	20,000,000	18,189,000	1½ % Q., Feb.	100	101
Union Traction Ry.............com	....	1,250,000	624,900	85 %	15¼	15½
Union Traction Co..............pref	100	2,000,000	2,000,000	5 % S.	57	58
Cincinnati, Ohio.–Aug 5:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	--	--
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	½ % Feb.	--	--
Cincinnati, Newport & Cov. St. Ry.	100	3,000,000	3,500,000	2½ % Feb.	75	76
*t*Cincinnati Street Ry. Co.	50	18,000,000	14,000,000	1¼ % Q., Jan.	124⅛	125
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan.	126⅛	127
Cleveland, Ohio –Aug 5:						
Akron, Bed. & Clev. Elec. Ry.	100	1,000,000	1,000,000	¾ % Jan.	48	50
Cleveland City Ry	100	8,000,000	7,600,000	8-5 % Jan.	100	102
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct.,	80	81
Detroit, Mich.–Aug 5:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	--
Ft. Wayne & Belle Isle Ry	100	....	1,200,000	....	175	--
Rapid Railway Co.	....	250,000	250,000	....	90	100
Detroit Electric Railway	....	1,000,000	1,000,000	....	...	--
Wyandotte & Detroit River Ry.....	100	250,000	200,000	....	100	110
Dayton O.–Aug 5						
City Railway Co............com.	100	1,500,000	1,470,600	1¼ % Q.	140	145
City Railway Co.............pfd.	100	600,000	600,000	1½ % Q.	170	--
People's Street Railway		1.100.000	1,100,000	....	114	115

* Unlisted. † Ex div.

a The United Railways & Electric Company comprises in its organization the Baltimore Consolidated Railway Company, the Baltimore City Passenger Railway Company, all the lines of street railway operated by these companies, and also the Central Railway Co of Baltimore. The pref stock of U R & Elec Co has been issued in the form of income bonds.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250 100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 85 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranted by West Chicago Street Railway Company, lessee.

t Cincinnati St. Railway purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Hartford Conn–Aug 5						
Hartford Street Ry. Co.	100	$4,000,000	$200,000	8 % S., Oct.,	150	-
Hartford & West Hartford	100	1,000,000	247,000	....	--	-
Holyoke Mass.–Aug 5						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., June,	207½	212
Hoboken N. J.–Aug 5						
North Hudson Co. (N. J.) Ry. Co...	25	1,250,000	1,000,000	8 %,	150	
Indianapolis, Ind–Aug 5						
**Indianapolis Street Ry	....	5,000,000	5,000,000	....	25	25½
Lancaster, Pa.–Aug 5						
Pennsylvania Traction Co.	100	10,000,000	9,900,000	....	--	--
Lancaster & Col. Electric Ry	....	....	37,500	....	--	...
West End Street Railway	....	....	....	....	--	--
Louisville, Ky.–Aug 5:						
Louisville Ry...............com.	100	4,000,000	3,500,000	1¼ %., April.	82	83
Louisville Ry................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1,	112	113
Minneapolis, Minn.– Aug 5						
Twin City Rapid Transit ....com.	100	17,000,000	15,010.000	....	89	89¼
Twin City Rapid Transit ....7 % pfd.	....	8,000,000	1,712,200	1¾ %. Oct.	186	187
Montreal, Canada.–Aug 5						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S., M. & N.	290	291
Toronto Street Ry. Co.	100	6,000.000	6,000,000	1¾ % S., J. & J. †	109¾	109⅞
Memphis Tenn.– Aug 5						
Memphis Street Railway Co.	100	500,000	500,000	....	25	--
New Haven, Conn.–Aug 5:						
Fair Haven & Westville RR.	25	2,000,000	2,000,000	8 % S., Sept.	39	41
New Haven Street Railway Co.....	100	1,250,000	1,000,000	2½ % A., July	...	...
New Haven & Centerville	100	700,000	800,000	....	--	--
Winchester Avenue RR.	25	1,000,000	600,000	....	45	46
New Orleans, La.–Aug 5						
Canal & Claiborne RR. Co.	40	240.000	240,000	4 % S., July,	--	--
New Orleans & Carrollton RR......	100	1,200,000	1,200,000	1½ % Q., Oct.	148½	158
New Orleans Traction Co new com.	100	....	....	....	26	28
New Orleans Traction Co new pfd.	100	....	....	....	102	103
*a*Crescent City RR.............guar.	100	2,000,000	2,000,000	3 % S., Jan.,	20½	26
*b*New Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan.,	--	--
Orleans Railroad	50	500,000	185,000	1½ %., June,	--	52
St. Charles Street Railway	50	1,000,000	1,000,000	1¼ %. Oct.,	56½	57
New York–Aug 5						
Central Crosstown RR.	100	600,000	600,000	2½ % Q.	255	260
*c*Christopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Oct.,	175	185
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q.,Nov.	120	185
*d*Metropolitan Street Ry. Co.	100	45,000,000	45,000,000	2½ % Q.,Feb.,1901.	163¼	163½
*e*Bleecker St. & Fulton Fy.Ry.guar	100	900,000	900,000	¾ % A., July,	35	37
*f*Broadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	241	249
*g*Cen. Park, N.&E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	205	210
*h*Eighth Avenue RR.	100	1,000,000	1,000,000	....	400	410
*i*42d St. & Grand St. Ferry RR.guar	100	750,000	748,000	4½ % Q.	392	402
*j*Ninth Avenue RR............guar.	100	800,000	800,000	....	198	200
*k*Sixth Avenue RR.............guar	100	2,000,000	2,000,000	....	208	210
*l*Twenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	400	410
Second Avenue RR.	100	2,500,000	1,8[illegible],000	2 % Q., Jan.,	210	212
Third Avenue RR.	100	12,000,000	10,0[illegible],000	$1.75 p. sh. Feb.	121	121
*m*42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,50[illegible],000	....	65	75¼
*Union (Huckleberry) Ry	100	2,000,000	2,00[illegible],000	....	190	200
Newark N. J. Aug 5						
Consolidated Traction Co of N. J...	100	15,000,000	5,000,000	....	67½	68
North Jersey Railway Co.	100	6,000,000	[illegible],000,000	....	24	25
United Elec. Co. of New Jersey..	100	504,000	504,000	11¼ % A.	283½	284
Pittsburg, Pa.–Aug 5						
Allegheny Traction Co.	50	500,000		....	27	28
*o*Consolidated Traction Co....com.	50	15,000,000		2 %, Jan.	20¼	21
Consolidated Traction Co.......pfd.	50	9,473,850		3 %, Nov.	59	60
*p*Central Traction Co.	50	1,500,000		1½ % Nov.	73⅛	73¼
*q*Citizens' Traction Co	50	3,000,000		6 % A.	72¼	72½
*r*Duquesne Traction Co	50	3,000,000		6 % A.	--	...
*s*Pittsburg Traction Co.	50	2,500,000		3½ %, Nov.	..½	--
Federal St. & Pleasant Valley Ry..	25	1,400,000		2½ %, July,	27	29
Pgh., Allegheny & Man. Trac. Co....	50	3,000,000		2 %, Aug.	--	--
Pittsburg & Birmingham Trac. Ry..	25	1,500,000		1 %, Oct.	41	42½
Pittsburg & West End Ry	50	3,000,000		5 % A., June	--	--
United Traction Co................com.	50	17,000,000		J. & J.	18¼	18½
United Traction Co..................pre	50	3,000,000		J. & J.		

* Unlisted. † Full paid. ‖ Outstanding. ‡ Ex-div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Ry. at 8 % on stock until Oct. 1, 1897; thereafter 9 %.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1895, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter.

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 % on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens' Duquesne, Fort Pitt & Pitt'b Traction.

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.

q Leased to Fort Pitt Traction Company for 6 % on $8,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock.

s Leased to Consolidated Traction Company for 7 % on capital stock.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
New Bedford Mass.—Aug 5						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb.	160	165
Northampton, Mass—Aug 5						
Northampton Street Ry	100	300,000	225,000	4 % A., June.	170	178
Omaha, Neb.—Aug 5						
Omaha Street Ry	100	5,000,000	5,000,000	3 % A. and N.	55	65
Paterson N. J.—Aug 5						
Paterson Ry. Co.	100	1,250,000	1,250,000	......	54	--
Providence, R. I.—Aug 5						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Oct.	169	110
Philadelphia.—Aug 5						
Fairmount Park Trans. Co...$50 pd.	50	2,000,000	1,770,000	2 %, Dec.	28	24
Hestonville, Man. & Fairmount....	50	1,966,100	‖1,966,100	2½ %, July 15,	47	48
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	588,900	‡588,900	3 % S—July,	75	76
*a*Fairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1,	26½	27
Union Traction Co..........$17½ pd	50	30,000.000	29,980,450	......	26¾	27
*c*Electric Traction Co.	50	......	8,297,920	......	--	...
*d*Citizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	345	--
*e*Frankford & Southwark Pas. R	50	......	‖1,875,000	$14 sha'e A—Apr.	450	451
*f*Lehigh Avenue Ry. Co.	50	1,000,000	......	......	48	...
*f*Lombard & South Street Ry...	25	......	1,000,000	A. & O.	90	90½
*d*Second & Third Streets Ry....	50	1,060,000	†771,076	$9 share A, Mar.	300	...
*c*People's Traction Co.	50	10,000,000	†6,000,000	3 %, A., April,	...	--
*g*Germantown Passenger Ry....	50	1,500,000	‖572,800	$5.25 share—	150	151
*g*Green & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan.,	151	152
*h*People's Passenger Ry....com.	25	1,500,000	‖740,000	......	...	...
*h*People's Passenger Ry....pfd.	....	750,000	‖277,402	......	...	...
*i*Philadelphia Traction Co.	50	30,000,000	‖20,000,000	$2 p. sh. Oct.	95	95¼
*j*Catherine & Bainbridge St.....	50	......	‖400,000	6 % A—Mar.,	...	--
*j*Continental Pass. Ry.....guar..	50	1,000,000	‖380,000	$6 share—July	158	157
Empire Passenger Ry. Co.	50	600,000	‖600,000	......	...	--
*j*Philadelphia City Pass. Ry.....	50	1,000,000	‖475,000	$7.50 share July	208	208¼
*j*Philadelphia & Gray's Fy. RR..	50	1,000,000	298,650	$8.50 share July	100	--
*j*Ridge Avenue Passenger Ry....	50	750,000	‖420,000	$12 share, July	308¾	309
*j*Philadelphia & Darby Ry.guar.	50	......	‖200,000	$2 share July, '	...	--
*j*17th & 19th Sts. Pass. Ry. guar...	50	......	‖250,000	1½ % S., July, '	--	--
*j*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖885,000	$11 sh. A., July,	300	--
*j*Union Passenger Ry. Co.	50	1,500,000	‖900,000	$9.50 shre, July	239	240
*j*West Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '	262	263
Rochester, N. Y.—Aug 5						
Rochester Railway Co	100	5,000,000	5,000,000	......	25	28
Reading, Pa.—Aug 5						
*j*Reading Traction Co	--	1,000,000	1,000,000	Semi-an.,Jan. & Jy	24	26
*k*City Passenger Ry	50	850,000	850,000	Jan.,	138	...
*l*East Reading Electric Ry	50	1,000,000	‡1,000,000	Jan.,	70	--
St. Louis Mo.—Aug 5						
Fourth Street & Arsenal Ry	50	800,000	150,000	......	--	--
Jefferson Avenue Ry. Co.	50	400,000	400,000	2 % Dec.	--	--
Lindell Ry	100	2,500,000	2,400,000	1¼ % Jan.	--	--
National Railway Co	--	2,500,000	2,479,000	1½ % Jan.	--	--
Cass Avenue & Fair Grounds....	--	2,500,000	2,500,000	......	--	--
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct.,	--	--
St. Louis RR	100	2,000,000	2,000,000	2½ %, Jan.,	...	--
Missouri RR	50	2,400,000	2,300,000	1½ % Jan.,	--	--
People's RR. Co	50	1,000,000	800,000	50c., Dec.,	--	...
United Electric Ry.........com.	50	500,000	500,000	......	24	25
United Electric Ry.......5 % pref.	100	1,000,000	1,000,000	3 %, Jan.,	78¼	79
St. Louis & Suburban Ry	100	3,000,000	2,500,000	......	90	93
Union Depot RR	100	4,000,000	4,000,000	3 % A., July,	--	--
San Francisco, Cal.—July						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	117	119
Geary Street Park & Ocean RR	100	1,000,000	375,000	$2.50 share,	50	--
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	61½	63⅛
Presidio & Ferries RR	100	1,000,000	550,000	......	--	16
Scranton Pa—Aug 5						
Scranton Railway Co	50	6,000,000	2,500,000	......	29	30
m Scranton & Carbondale Trac. Co..	100	500,000	500,000	......	16½	...
m Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	......	--	--
Springfield Ill.—Aug 5						
Springfield Consolidated Ry	100	750,000	750,000	......	--	--
Springfield O.—Aug 5						
Springfield Street Ry	100	1,000,000	1,000,000	......	--	11
Springfield, Mass.—Aug 5						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	207	212
Toronto Canada.—Aug 5						
Toronto Street Ry	100	6,000,000	6,000,000	1¾ % S.	109¼	110⅜
Montreal Street Railway Co	.....	4,000,000	4,000,000	4 % S.	279	280
Washington, D. C.—Aug 5						
Belt Ry. Co	50	500,000	500,000	......	--	--
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct.	103⅛	103⅞
Columbia Ry. Co	50	400,000	400,000	6 % A.	--	...
Eckington & Soldiers' Home Ry....	50	707,000	652,000	......	35	40
Georgetown & Tenallytown Ry.....	50	200,000	200,000	......	20	21
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	--	--
Worcester, Mass.—Aug 5						
*Worcester Traction Co.......com.	100	3,000,000	3,000,000	......	32¼	35
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb.,	107	108
Worcester & Suburban Street Ry...	100	550,000	542,500	4½ %,	...	85
Wilkesbarre, Pa.—Aug 5						
Wilkesbarr & Wyoming Val Trac..	100	5,000,000	5,000,000	1%, Jan.,	25	26

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* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex-div.

a Leased to Hestonville, Man & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Company at a rental of $10,000 per annum in 1866-7-8, a. $20,000 in 1899-1900 and $30 000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6 % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Co., formerly Scranton Traction Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Boston, Mass.—Aug 5						
American Tel & Tel Co	100	50,000,000	33,650,000	4½ % Q., Jan.	158⅞	159
Erie Telegraph & Telephone Co....	100	......	......	1 % Q., Feb. 20,	48	48¼
New England Telephone Co	--	10,394,600	10,304,600	$1.50 p. sh. Feb	139	140
New York.—Aug 5						
American Telegraph & Cable Co...	100	14,000,000	14,000,000	1¼ % Q	91	94
*Central & South Am. Teleg. Co.....	100	6,500,000	6,500,000	1½ % Q.	100	105
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	173	175
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	42	50
Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1 % Q., Feb.,	--	--
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	108	109
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	116	118
Mexican Telephone Co	100	2,000,000	......		2	2½
*New York & New Jersey Tel. Co..	100	5,000,000	3,723,000	2½ % Q., Jan.,	168	178
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	70	75
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	--	--
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	95	100
†Commercial Union Telegraph Co...	25	500,000	500,000	3 % S., Jan.,	115	--
Western Union Telegraph Co	--	......	97,370,000	1¼ %, Q, Jan.	90⅛	90¼
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Aug 5:						
American Dist. Teleg. (Phila.).....	25	400,000	......	1 % Q.	26	37
Bell Teleph. Co. (of Canada.)	100	3,960,000	3,564,000	2 % S.	188	--
Chesapeake & Potomac Telep. Co..	100	......	......	....	67	70
Chicago Telephone Co	100	......	......	......	200	240
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	148	150
Empire & Bay States Telegraph Co.	...	......	......	....	75	76
Hudson River Telephone Co	109	2,000,000	2,000,000	1 % Q.	120	125
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	122	125
Providence (R. I.) Teleph. Co.	50	......	......	....	96	99
Southern New Eng. Teleph. Co....	100	8,000,000	......	....	...	--

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 5						
Fort Wayne Electric trust receipts..	--	......	......	....	115	125
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	15	25
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	--	
General Electric Co. [new]...... "	100	18,276,000	18,276,000	1½ % Q., Apr., 1901	251¾	252
T.-H. Elec. Co..T. Secur., Series C.	--	......	......	....	22	26
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	70	70¼
Westinghouse El. & M'fg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q.,	75¾	76
Westinghouse El. & M'fg. Co. rights.	50	11,000,000	8,195,126	......	1¾	1⅞
New York.—Aug 5						
Edison Elec. Ill'g Co., New York..	100	9,188,000	7,988,000	....	119	120
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	2,000,000	1½ % Oct., '98.	--	--
Edison Ore Milling Co	100	......	......	....	8	12
Electric Vehicle Co.........com.	--	......	......	....	--	--
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	--	...
General Electric Co. [new].... "	100	18,276,000	18,276,000	1½ % Q.,Apr., 1901	252	252⅛
Interior Conduit & Insulation Co...	100	1,000,000	1,000,000	....	41	--
‖ Kings Co. El. L. & P. Co.	100	2,500,000	2,500,0 00	A. & O.	110	125
Pittsburg, Pa—Aug 5						
Allegheny County Light Co	100	500,000	500,000	J. & J.	168	172
East End Electric Light Co	50	300,000	300,000	Q	--	--
Philadelphia, Pa.—Aug 5						
Edison Electric Light Co	100	2,000,000	......	......	144	144⅛
*Electric Storage Battery Co..com.	100	8,500,000	......	......	75	80
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	75	80
Northern Elec. Light & Power Co..	10	550,000	550,000	......	13	13½
Southern Elec. Light & Power Co..	10	187,500	187,500	....	30	--
Miscellaneous.—Aug 5						
Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	......	......	47	48
Missouri-Edison (St. Louis)....com.	--	......	......	....	20	21
Eddy Electric Mfg. Co	25	......	......	....	9	12
Hartford (Conn.) Elec. Light Co....	100	350,000	......	....	190	191
Hartford (Conn.) Lt. & Power Co..	25	175,000	......	....	6	10
New Haven (Conn.) Elec. Lt. Co....	100	100,000	......	....	195	--
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct.,	103	104
Rhode Island Elec. Protec. Co.	100	......	......	....	118	120
Royal Elec. Co. (Montreal)	--	1,000,000	.....	1% Q	‡250	251
Toronto (Canada) Elec. Light Co...	100	1,085,000	1,085,000	1¾ % Q	136	138
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1,	--	100
Woonsocket (R. I.) Electric Co.....	100	......	......	....	105	106

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

‖ Recently acquired the Edison Illuminating Co. of Brooklyn and its constituent company, the Municipal Electric Light Co.

ALLIED INDUSTRIES.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Aug 5						
American Electric Heating Co	50	10,000,000	......	......	--	--
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh.	--	--
United Electric Securities Co...pfd.	100	......	1,000,000	$3.50 p.sh.	--	100
New York.—Aug 5						
Consolidated Electric Storage Co...	...	......	......	....	8	12
Safety Car Heating & Lighting Co..	100	......	......	......	150	155
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	--	--
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 % A	113	114
Philadelphia Pa.—Aug 5						
Electro Pneumatic Trans. Co	10	1,500,000	......	--	1⅜	1⅝
United Gas Improvement Co..scrip.	50	10,000,000	......	--	--	162
Welsbach Commercial Co.....com.	100	3,500,000	......	--	20½	21½
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	73	75
Welsbach Light Co	5	525,100	......	....	54	55
Welsbach Light Co., Canada	5	500,000	......	....	1	1½
Pittsburg, Pa.—Aug 5						
Carborundum Mfg. Co	100	200,000	200,000	....	--	--
Standard Underground Cable Co.	100	1,000,000	1,000,000	Q	224	225
Miscellaneous.—Aug 5						
*Barney & Smith Car Co.......com.	100	......	1,000,000	--	20	25
*Barney & Smith Car Co........pfd.	100	......	500,000	2 %	120	129
Billings & Spencer Co	25	......	......	....	32	--
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb	54	56½
Johns-Pratt Co	100	......	......	--	105	109
Pratt & Whitney Co.........com.	100	......	......	--	--	
Pratt & Whitney Co...........pfd	100	......	......	--	85	90
Stillwell-Bierce Co............com.	--	......	......	--	--	50
Stillwell-Bierce Co............pfd.	--	......	......	2 % Sept	65	70
Shults Belting Co	100	300,000	......	....	80	90
St. Charles Car Co	--	......	......	......	80	88

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany N. Y.

Date of Quotation—Aug 5, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry. Co......Cons. mtg. 5s	$500,000	427,500	1940	J. & J.	117½	......
†The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*116½	......
‡Watervleit Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*125	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*124	126
Troy City Railway Co....................1st 5s	....	....	1942	......	*116½	118

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Aug 5. 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
United Electric Ry. Co...1st mtg. g. 4s	88,000,000	18,000,000	1949	M. & S.	102	102¾
" " " ....income 4s.	14,000,000	....	1949	J. & D.	74¾	75
Baltimore City Pass. Ry..1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	118⅞	......
†Baltimore Traction Co......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	119	120
†Baltimore Trac. Co. Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	104½	......
†Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	121	121½
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	101	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	102½	......
†Central Pass. Ry. Co.........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
†Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	119	121
†City & Suburban Ry.....1st mtg. g. 5s.	8,000,000	8,000,000	1922	J. & D.	116	117
†Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	117	......

☞ All of the bonds of the above companies, marked †, have been assumed by the United Railways & Electric Company.

Boston Mass.

Date of Quotation—Aug 5, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	114	115
West End Street Ry.........Deben. g. 5s.	8,000,000	3,000,000	1902	M. & N.	104½	106
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	112	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Aug 5, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	....	....
†Charleston City Ry...........1st mtg. 6s.	850,000	....	....	J. & J.	106	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Aug 5, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry..............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¾	2¾
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	108½	109
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	8,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	96	96½
North Chicago St. RR.........1st mtg. 5s.	8,171,000	8,171,000	1906	J. & J.	106	......
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	......
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	......
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	108	......
West Chicago St. RR..........1st mtg. 5s.	4,100,000	8,969,000	1928	M. & N.	......	111
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	101	102
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	....	106⅝	107
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	....	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee
§Int. guar. by W. Chicago St. RR. Co

Cincinnati O.

Date of Quotation— Aug 5 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	8,000,000	2,500,000	1922	J. & J.	114½	115
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103½	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	114	......
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	581,000	581,000	1906	M. & S.	108¾	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	121½	122½
‡So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	132¾	137

† Assumed by the Cincin. St. Ry. Co.
‡$250,000 reserved to retire 1st mtg. bds.

Cleveland O.

Date of Quotation—Aug 5, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co.......1st mtg. 6s.	600,000	600,000	1908	M. & S.	106½	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	8,000,000	2,500,000	1922	J. & J.	113½	114¼
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	105½	106
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	8,500,000	1,249,000	1918	M. & S.	106	107
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
aEast Cleveland RR...........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	......	107½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Aug 5, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	8,885,000	1905	A. & O.	......	102½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	877,000	1902	A. & O.	....	....
The Detroit Ry.................1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	105	106½

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation— Aug 5 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St Ry............1st mtg. g. 5s...	600,000	600,000	1918		111	....
New Haven, Edgewood Div., 1st mtg. 5s.	250,000	250,000	1914	J & D	111	......
Winchester Avenue RR., 1st mtg. g. 5s..	100,000	500,000	1912	M& N	109	......
Winchester Avenue RR..... Deben. g. 5s.	100,000	24,300	1919	M& S		

New Orleans La.

Date of Quotation—Aug 5 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR....cons mtg. 6s	$150,000	$150,000	1912	M. & N.	......	....
Crescent City RR..............1st mtg. 6s	......	50,000	1899	M. & N.	105¼	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	8,000,000	1948	J. & J.	......	....
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1908	J. & D.	108	112
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1948	J. & J.	112	113
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	......	......
Orleans Railroad Co........Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	......	......
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	......	......

†$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation— Aug 5 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn).....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	......
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107½	110
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	8,000,000	1,966,000	1931	A. & O.	115	116
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	123	125
Broadway & 7th Ave..........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	101	105½
Broadway & 7th Ave...........2d mtg. 5s.	500,000	500,000	1914	J. & J.	108	110
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface..............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	115	116
¶Brooklyn, Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	101	....
Brooklyn Heights RR.......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	......
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	8,500,000	8,500,000	1941	J. & J.	112	....
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	107	....
Brooklyn Rapid Transit..........gold 5s.	7,000,000	5,181,000	1945	....	109½	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	98½	100½
Cent P'k, N. & E. R. RR. 1st cons. mtg. 4s.	1,200,000	1,200,000	1902	J. & D.	107	109
Central Crosstown RR.........1st mtg. 6s.	250,000	250,000	1922	M. & N.	125	......
Coney Island & Brooklyn RR. 1st mtg. 5s	800,000	800,000	1908	J. & J.	101	103
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1932	J. & D.	117	120
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	100,000	1,100,000	1914	F. & A.	102	105
Eighth Av. RR. Co......Cert. indebt. 6 %.	000 000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	,200,000	1,200,000	1910	M. & S.	116½	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	89	......
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	124	125
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	120	......
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600 000	1909	M. & N.	120	121
Second Avenue Ry..............Deb. 5s.	800,000	800,000	1909	J. & J.	108½	109
Steinway Ry. (L. I.)........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	116	117
South Ferry RR. Co...........1st mtg. 5s.	850,000	850,000	1919	......	110½	112½
Third Avenue RR............1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	......	128½
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	.....	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	106	108
Union (Huckleberry) Ry......1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	116
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	114

†$1,085,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation— Aug 5 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.........................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry..............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—Aug 5, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry.............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.......................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry...........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	....	1948	......	....	....
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J &	......	....
Philadelphia Trac. Co.........Coll. tr. g. 4s.	1,800,000	1,018,000	1917	F. & A.	......	......
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry................1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co.................Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	——	......
West End Passenger Ry....... 1st mtg. 7s.	....	....	1905	......	....	....
West Phila. Pass. Ry..........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	......	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	......	......

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation— Aug 5 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	111½	....
Central Traction Co................1st mtg. 5s.	875,000	875,000	1930	J. & J	......	......
Citizens' Traction Co..............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	......	......
*Fed'l St. & Pleas. Val. Jack's Run......5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley.........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	110	118
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co.............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	118
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co.....................5s.	2,500,000	2,029,000	1934	J. & D.	......	....
Sub. Rapid Transit Railway Co..........5s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Aug 5 901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry..................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	116	118

St. Louis.

Date of Quotation—Aug 5, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baden & St. Louis RR.........1st mtg. 5s	250,000	250,000	1912	J & J	101½	......
Cass Ave. & Fair Gds Ry......1st mtg. 5s	1,818,000	1,818,000	1912	J & J	101½	......
Citizens' Railway Co.......1st mtg. 5s	2,000,000	1,500,000	1907	J & J	109	
Comp. Hts. Un. De. & Mer. Ter...1s	1 000 000	000 000	191	J& J	[illegible]	

With interest Unlisted

Unlisted With interest

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation— Aug 5 1901						
Jefferson Avenue Ry............1st mtg. 5s.	270,000	270,000	1905	M. & N.	102	108
Lindell Ry. Co......................1st mtg. 5s	1,500,000	1,500 000	1911	F. & A.	107	108
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	105	106
‡Mound City RR. Co..............1st mtg. 6s.	400,000	300,000	1910	A. & O.	104½	105½
People's RR. Co.....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	....	......
‖People's RR. Co....................2d mtg. 7s.	75,000	75.000	1902	M. & N.	......	......
People's RR. Co................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	......	......
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	99½	100½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry................Income 5s.	800,000	800,000	......	....	80	84
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	106	108
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	116½	117½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	100	100½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	121	122
†Controlled by St. Louis RR. Co. ‡Controlled by Union Depot RR. Co. ¶Controlled by Lindell RR. Co. ‖$200,000 in escrow to retire 1st & 2d mtg. §$600,000 in escrow. ††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—June 1901.						
California St. Cable RR....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	117
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	......	95
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	126¼	......
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co..............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126¼	......
†Park & Cliff House RR........1st mtg. 6s.	850,000	850,000	1912	J. & J.	105½	107
†Park & Ocean RR...............1st mtg. 6s.	250,000	250,000	1914	J. & J.	115	......
†Powell St. Ry......................1st mtg. 6s.	700,000	700,000	1912	M. & S.	.....	125
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation— Aug 5. 1901						
Belt Ry. Co........................Cons mtg 5s.	500,000	450,000	1920	J. & J.	......	....
Columbia Ry........................1st mtg. 6s.	500,000	500,000	1914	A. & O.	129	......
Eckington & Soldiers' Home. 1st mtg. 6s.	200,000	200,000	1911	J. & D.	......	......
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	......	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation– Aug 5, 1901						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	108	110
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	118	. ..
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	104	105
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,866,000	1932	M. & N.	112	113
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	115	......
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	111¼	111⅝
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	115	115½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	20	..
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	85
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	119	119½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	110¼	110¾
††No. Hudson Co. Ry. (N.J.).Cons. mtg. 5s	3,000,000	2,878,000	1928	J. & J.	108	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.).......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	....	......
Rochester (N. Y.) Ry...........1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	......	......
St. Paul City Ry...................Cons. g. 5s.	5,500,000	4,298,000	1937	......	105½	106
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	108	....
†$1,000,000 in escrow to retire 1st and d mtg. bds. ‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co. ¶$760,000 in escrow to retire bonds of C. St. RR. Co. ‖$87,000 in treasury. §$960,000 res'ved to redeem prior liens. ††$620,000 in escrow.						
					*With int're	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS

Boston, Mass.						
Date of Quotation— Aug 5, 1901.						
Delaware Gas Lt. Co.,.........1st m. 5s, g.	800,000	800,000	......	J. & J.	106	108
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	157	....
General Electric Co..gold coup, deb. 5s..	10,000,000	3,750,000	1922	....	116	......
Pittsburg Pa						
Date of Quotation— Aug 5. 1901						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	110	......
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Aug 5 1901.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	109	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1998	......	124	......
Edison Elec. Illg. Co. (Brooklyn).......	5,000,000	5,000,000	1940	....	122¾	124
Edison Electric Light (Philadelphia)..	2,000,000	......	....	.....	. ..	......
Kings Co. El. Lt. & Pow. Co. 1st mtg. 5s.	2,500,000	......	1937	A. & O.	100	105
Kings Co. El. Lt. & Po. Co. pur. money 6s	5,176,000	....	1997	A & O.	120	122
Milwaukee El. Ry & Lt. Co. 1st con. g. 5s.	3,000,000	....	......	F. & A.	102½	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Aug 5. 1901.					100½	101
American Bell Telephone....................4s.			1908	F. & A.	......	....
Northwestern Telegraph Co...............7s.	....	......	....	......	....	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	114	115
Chesapeake & Potomac Teleph. Co....5s.	....	......	1911	J. & D.	103	106

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation— Aug 5 1901.						
American Electric Heating............. 7s	500,000	500,000	....	....	....	......
Armington & Sims Engine Co.............	....	....	......	......	......	25
Barney & Smith Car Co......................6s.	....	....	1942	J. & J.	106	107
Carborundum Mfg Co..........................6s.	....	....	1904	J & D.	......	......
Worthington Pump Co......................	75,000	....	......	......	115	117

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 16⅝@16¾c.; Lake, 16½@17c.; casting, 16⅜@16½c.

The annual meeting of the Boston Electric Light Company will be held in Boston on August 13.

A local paper states that insiders in Brooklyn Rapid Transit are expecting important increases in earnings from the new traffic to Coney Island to be developed by the creation of an important new park there.

The new Inter-State Telephone Company is buying up stock of the Mutual Telephone Company, which was formed in Elizabeth, N. J., in 1895. It aims in its fight against the Bell Company to absorb all local companies and establish a State telephone exchange.

A writ of mandamus has been granted to the Edison Electric Light Company in the Supreme Court, Brooklyn, commanding the Board of Assessors of the city of New York to correct and reduce the company's assessment for 1897 from $900,584 to $750,000.

The following are quotations for some of the industrial stocks not quoted elsewhere: Electrical Lead Reduction, 1¾@2¼; Electric Boat, 17@20; Electric Vehicle, 5½@7; Tel. & Tel. Company of America (full paid), 4@6; Electric Company of America, 7@7¼; National Carbon, 16¾@17.

Engraved certificates of Amalgamated Copper Company stock are now being issued by Kidder, Peabody & Co., transfer agents, in exchange for the temporary certificates. Both the engraved and temporary certificates will constitute a good delivery until August 7. After that date the engraved certificates alone will constitute a good delivery.

The executive committee of the General Electric Company met on Friday, but officials say that nothing but routine business was transacted. Nothing definite is yet known in regard to the time at which action may be taken on the matter of increasing the stock of the General Electric Company and distributing the new stock as a dividend to stockholders. It is said in quarters where there has been good information heretofore that nothing will be done for some little time to come at least.

A dispatch from Oshkosh, Wis., states that the entire plant of the Winnebago Traction Company, including the Oshkosh Electric Street Railway System of seventeen miles; the Interurban line of 13 miles, connecting the Oshkosh and Neenah Electric Park line of four miles and other property, is virtually sold to the Milwaukee Electric Railway and Light Company. The sale of the system is important in that it constitutes an important link in the proposed electric railway system from Chicago to Green Bay, a distance of 198 miles, of which lines aggregating 106 miles are now in operation.

The Consolidated Street Railroad Company, which will be incorporated in Utica within a few days, will, it is believed, be the nucleus of a gigantic electric road system in central New York, with the object of competing for passenger traffic with the steam roads and the American Express Company. The new company will be capitalized at $3,500,000. It is represented by Horace E. Andrews of Cleveland, O., a son of a former partner of John D. Rockefeller in the oil business. Associated with him are a number of New York capitalists. Mr. Andrews' syndicate now controls all street car companies in Utica.

At an adjourned meeting of the stockholders of the Birmingham (Ala.) Railway, Light and Power Company, which recently acquired the street railway, gas and electric light properties of Birmingham, the directors were increased from nine to fifteen, and among the new directors elected were Gordon Abbott, of the Old Colony Trust Company, of Boston; Henry M. Atkinson, of Atlanta, and J. K. Newman, of New Orleans. Mr. Atkinson represents the trust company and engineered the deal, and Mr. Newman represents Isador Newman, who controlled the absorbed gas interests. The Consolidated Company has authorized an issue of $6,000,000 of bonds, with the Old Colony Trust Company as trustee, and $1,000,000 has been set aside for street railway improvements and extensions, already begun. Robert Jemison was elected president.

The brokerage firm of Knight, Donnelly & Co., of Chicago, has prepared an analysis of the Chicago Union Traction Company's report of operations in the fiscal year ended June 30 last. The analysis shows some important statistics that the management of the company saw wise to keep off the public report this year. This is the meat of the analysis: "The recent report of the Union Traction Company confirms us in the belief we have heretofore entertained that the saddling of the Consolidated Traction Company on the Union Traction Company was the true reason of its subsequent financial troubles—reduced earnings, increased fixed charges, increased operating expenses, increased general expense and passed dividends. We observe that the passenger traffic density of the system for the year just ended was only 289,207 revenue fares per mile of line. But for the year 1899 the North Chicago Street Railroad Company, operated separately, showed a traffic density measured by 645,076 revenue passengers per mile of road. Obviously the North Chicago road was immensely profitable, though it operated only 97 miles of lines. It was so profitable that Mr. Yerkes was able to lease it on a 12 per cent. guaranty basis. What the Consolidated Traction Company was doing cannot be ascertained. The Consolidated Traction Company should not have been taken over by the Union Traction Company at so high a price—it was poor policy to do it, even though there seemed to be almost compulsory consideration prompting that course. But since the damage has been done and the deal cannot be revoked, there is nothing for the Union Traction Company to do but struggle on under its load until the density of suburban traffic shows a very great increase. Of course we presuppose that the city and the company will be able to reach some settlement of the franchise-extension question which will not impose an added burden on the company."

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EDITORIAL NOTES.

The Use of Gasoline for Lighting.

The disastrous explosion of presumably gasoline in a store in Philadelphia on the evening of August 5, in which accident a number of persons lost their lives and a score of others were more or less severely injured, should serve as a forcible object lesson on the use of gasoline, especially for lighting purposes.

In spite of the fact that fire underwriters frown down the use of gasoline for lighting purposes and restrict its use in many ways, there are numerous such lighting plants in existence in various parts of the country. Referring to this subject Mr. W. C. Stockdale, president of the Southeastern Tariff Association of Fire Underwriters, is reported as saying:

"The use of gasoline generators for lighting, and the use of gasoline vapor lamps for lighting purposes is being extended until it has become a very serious question. The people who are interested in the manufacture and sale of these lamps, as well as those connected with the gasoline business, are claiming, without authority, that the National Board and other organizations of fire underwriters are approving the lamps, and in this way people are encouraged to use them. I do not believe that there is any system of lighting which is more dangerous than that of gasoline lamps, and, in my opinion, it matters not how nearly perfect they may be made nor how well they may be protected. Of course, this system of lighting is yet in its infancy, so we can handle it very easily. It would be out of the question, perhaps, for us to prohibit the use of gasoline lamps, but we certainly have the power to impose such a charge on account of their use that policy-holders will be very slow to adopt anything of the kind as a means of lighting their premises."

The fact that the management of the World's Fair, Omaha Exposition, Paris Exposition and the Pan-American positively prohibited the use of gasoline in any form is evidence of its dangers.

In order to get some idea of the damage that has been wrought by gasoline explosions since the beginning of this year, it is only necessary to scan the pages of a little work entitled "Is Gasoline Lighting Dangerous?" brought out by the Illuminating Publishing Company, of Cincinnati. Here statistics may be found which are certainly startling. It seems incredible that so many gasoline lighting plants are tolerated by fire underwriters and local authorities, where even small towns are now provided with up-to-date electric lighting plants. It has frequently been stated that the electric current is yearly responsible for many fires, but we venture to say that there is more damage done and loss of life in one month through the use of gasoline than in the whole twelve months with electricity. Furthermore, electricity embodies no dynamite qualities.

* * *

The Underground Electric Lines of London.

Several interesting reports have just been made public showing the doings of the London underground lines for the past six months. The statements regarding the Metropolitan and District lines show that the respective boards are obdurate, one pinning its faith entirely to the experimental Ganz system and the other declining to move from its predilection for the Yerkes method. It certainly looks as though there is no possibility of an agreement being arrived at without the intervention of a Board of Trade Tribunal such as a Parliamentary Committee has proposed.

The Central London Railway has managed to maintain a 4 per cent. dividend on the ordinary capital for its second half-year's running, and it has taken away the business of the Metropolitan to such an extent as to cause it a loss of traffic producing $210,000. This would have paid nearly 1¼ per cent on the Metropolitan stock.

The City and South London Railway, about whose extension to Islington our London correspondent has written on several occasions, is now nearly finished, and it is said to be in such a state as to insure the running of trains from end to end, viz., from Clapham to Islington by the end of September. The City and South London will then be longer than the Centra London. It is interesting to mention that the City and South London management, which has for years strained every possible point to keep down the working expenses, has this six months succeeded in bringing them lower than ever. They work out at about 52.6 per cent. o the receipts and this includes the cost of operating the lifts for conveying passengers from and to the surface. If there were no lifts the costs would be about 41 per cent., and this compares remarkably well with the showing of English steam railways for the past half year, the figures here being about 70 per cent. of the receipts. Few facts could be produced testifying so powerfully to the benefit of electricity for the operation of such lines.

It has now been definitely resolved that the greater number of the new underground electric projects shall remain over for the present, the reason being that it is thought essential that the entire problem of underground systems shall be thoroughly investigated with a view to the progress following upon well considered lines and principles. It is held in many quarters that this delay does not much matter, for the financial situation is not such as to render it likely that the public would find the money required for them at the present moment.

* * *

The Prospect of Trade With Spain.

The prospects of American manufacturers securing a large share of the Spanish trade are very hopeful. Already, in spite of the discriminating tariff, American electrical machinery and apparatus are finding a good sale in the country of the Dons, as will be seen from a perusal of the official statistics of the past two years. In 1899, American electrical machinery to the value of $3,326 was imported into Spain, while in 1900 the value had increased to $14,753. In imports of American instruments and apparatus for scientific purposes, including telegraph, telephone and other electric, the increase is even greater, the value for 1899 being $7,747 as compared with $37,614 for the fiscal year just ended. If a reduction of the present tariff can be obtained by a new treaty it is believed a great development in the importation of our electrical goods will follow.

It has been pointed out that Spanish buyers are accustomed to having two or three months' open credit in which to pay their invoices. German and French firms sell on these terms, and many British houses have found it necessary to do the same or lose their connections. Our exporters, being of course mostly unacquainted with Spanish buyers, will sell only against London or Paris bank credit, and argue that if European sellers accept payment of their invoices three months after date, they must add the interest for that time to their selling price, besides something to cover their risk. This may be true, but it must be borne in mind that the Spanish merchant is obliged by the custom of the trade in his country to grant to his customers very long credits. It is therefore necessary for him to buy without having to pay cash for his purchases. Further, it must be remembered that the rate of interest is higher in Spain than in England, Germany or France. Some of the leading Barcelona importers do furnish bankers' credit, but in cases where our exporters have succeeded in selling on these terms, they should be ready at once to consider any complaint or claim made by the buyer on the score of quality, placing the settlement of the dispute in case of need in the hands of some responsible third party. In this way, the buyer will learn to have confidence in our firms and will be less prejudiced against allowing them to cover themselves for the value of their invoice by a bill on his bankers before he has received the goods.

Special stress is laid on the importance of making the Spanish buyer feel that he has nothing to fear from having virtually paid for his purchases before arrival. Any ill-feeling against us as a nation that may have been engendered by the late war is fast disappearing, if indeed any trace of it now exists at all, and we ought to be able to render Spain one of our best foreign markets. By appointing trustworthy and efficient agents American firms will quickly learn that the majority of Spanish merchants are reliable and straightforward business men.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

THE members of the American Institute of Electrical Engineers together with the foreign guests that are expected will meet at the headquarters of the Institute, 12 West 31st street, Wednesday morning (to day) at 11 o'clock, when addresses of welcome will be made, which will be followed by a collation.

MR. PAUL JANET of Paris will represent the International Society of Electrical Engineers at the coming meeting of the American Institute at Buffalo.

PROF. GUSTAVE GILLON, of the University of Louvain, Belgium, has been sent to this country by the Belgian Government to make a study of up-to-date electrical development.

SPEED contests between locally owned automobiles are suggested for the St. Louis Fair next October.

GEN. EUGENE J. GRIFFIN, vice-president of the General Electric Company, has just returned from Europe, but his stay here will be brief on account of business interests abroad.

THE city of Buffalo will appropriate $200 to assist in the entertainment of the delegates to the International Association of Municipal Electricians, which will hold its annual convention there in September.

ON July 29 an electrically propelled carriage covered a distance of ninety miles in England on one battery charge, running over very muddy roads with two passengers from London to Calne. The vehicle including everything weighed 3,125 pounds, the storage battery weighing 1,700.

A NEW development of the trolley railroad business in Connecticut is the freight and express service, and this bids fair to give the steam road and express companies, which have had the monopoly of the carrying trade for years, the liveliest kind of competition.

THE Swedish Government, according to a dispatch from Stockholm to the "Politische Correspondenz," of Vienna, is considering plans for the installation of electricity throughout the whole railway system of Sweden.

IT is stated that a Detroit, Mich., baseball player has completed the construction of a portable electric plant for playing baseball at night.

NEARLY 200 miles on one battery charge is the latest performance of an electric automobile, setting a new mark for these vehicles. The machine is the joint output of two Cleveland companies and a Chicago company. The performance of the new machine is due to the advanced improvement in those parts of the machine, battery, motor and running gear, which enable it to cover more than twice as many miles on one charge as has heretofore been done by electric vehicles. The test was made on the Chicago Boulevard between 3 o'clock P. M. August 5 and 2:30 A. M. August 7.

CONSUL WARNER, at Leipsic, Germany, reports that a recently patented insulating material is made by taking pulverized casein and mixing it with vegetable oils. The mixture, to which rubber, caoutchouc, resin, or coloring matter may be added, is pressed into forms and dried, or vulcanized by the addition of sulphur.

OFFICIAL test of the Fulton, the second of the Holland submarine boats to be completed will be made on the Government course in Peconic Bay during this week. The Fulton is one of seven vessels of the submarine type which the Holland Company is under contract to furnish to the Government. The Holland, the first of the boats completed, is already in the Government service.

THE success of recent experiments in wireless telegraphy has caused a revival of interest on the part of the Boston Chamber of Commerce, which for some time past has been considering with the Maritime Exchange of New York the matter of placing instruments on lightships along the coast. Now that a station is nearly completed on the Nantaucket Shoals lightship, and the Cunard Company has had such success in its experiments on the Lucania, interest in wireless telegraphy in Boston is becoming deeper.

FRIDAY morning the battleships Alabama, Kearsarge and Massachusetts passed Wood's Holl, Mass., on their way to anchorage above Nobscot, where they will receive on board equipment for wireless telegraphy. The ships have been engaged in target practice off No Man's Land, and will proceed to Nantasket.

THE Automobile Club of Maine has been formed in Portland, with 25 charter members. The officers of the club are Maynard D. Hanson, president; Samuel S. Boyden, treasurer; and Henry M. Jones, secretary.

CONSUL GENERAL HUGHES, at Coburg, Germany, reports to the State Department at Washington that a French-Belgian syndicate is reported to be forming, under the patronage of the King of Belgium, to build an electric express line for passengers and light freight between Paris and Brussels, and from the latter place to Antwerp. The trip from Paris to Brussels is expected to be made in one and a half hours, and from Brussels to Antwerp in ten minutes.

ST. LOUIS, MO., has a new roofless street car which seats about 128 passengers, and which runs in the evening during the summer. The car is known as the Moonlight, and is built after the plans of an ordinary car, except that the roof will be lacking and the bell and fare recorder ropes will run along the footboard. The car is designed for comfort principally. Light will be provided by a cluster of electric lamps in front of a powerful reflector at the rear of the car. The car is an experiment, and if it proves a success the Transit Company, will equip all lines with them.

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IMPROVED wireless telegraphy is to be tried between Boston and Danvers, Mass., where an electrical and telegraph school has bought a farm of sufficient area for running electric cars in connection with a course of instruction for motormen. A station in South Boston, where experiments with wireless telegraphy have been made in the past, is no longer to be used for that purpose, and the instruments will be transferred to Danvers.

◆

ACCORDING to the "Electrician," London, a department for treating lupus vulgaris by means of electric light has recently been opened at the Manchester and Salford Hospital for skin diseases. At present one arc lamp of about 30,000 nominal candle-power has been installed, but by an arrangement of collectors four patients can be treated at the same time. The collectors are made of Siberian rock crystal filled with distilled water. The portion of the skin being treated is compressed with two pieces of glass set in a metal frame, between which a constant stream of cold water is kept running. The pressure is to remove the blood from the skin, while the flow of water helps to further keep the skin cool. About a quarter of a square inch is treated for about 50 minutes; antiseptic ointment is then put on, and in a few days the skin is completely healed. Twenty patients can be treated each day.

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HUNGARY, like Servia and Roumania, now holds out inducements to parties who will start industrial enterprises in that kingdom, according to a communication received at the State Department from United States Consul Listoe at Rotterdam. It is stated that the Government of Hungary will grant subsidies to manufactories of textile goods, agricultural machinery, silk, for the manufactures of articles of lead, zinc and tin by electricity and a number of other enterprises.

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IT will be remembered that Nansan's ship Fram was equipped with a windmill coupled to a dynamo for her Arctic voyage to be used for charging storage batteries when her engines were not at work. The steamship Discovery, according to the London "Electrician," has also been fitted in the same way for her Antarctic trip. In this case, however, a windmill coupled to two dynamos is made use of which are connected to help each other when the wind is light, or to oppose each other when the wind is strong.

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AUTOMOBILISTS will be interested to know that the Westchester, N. Y., Lighting Company which controls all of the electric plants in the county, is arranging to establish stations at convenient places in Westchester County where automobiles may be charged. These plants will be ready for use next season. F. A. Stratton, the manager, says that the company intends to make it possible for vehicles to make a complete circuit of Westchester County by electricity, coming from New York, up the Boston Post Road, through New Rochelle, Larchmont and Mamaroneck, as far as Port Chester, from thence the Albany Post Road through Ardsley, Dobbs Ferry and Yonkers to New York. The company may also take up the question of establishing stations on the water front and furnishing power to electric launches. The number of explosions on gasoline and naphtha launches the last year has led many wealthy people to prefer electric launches, if they could get the power to run them without too much inconvenience.

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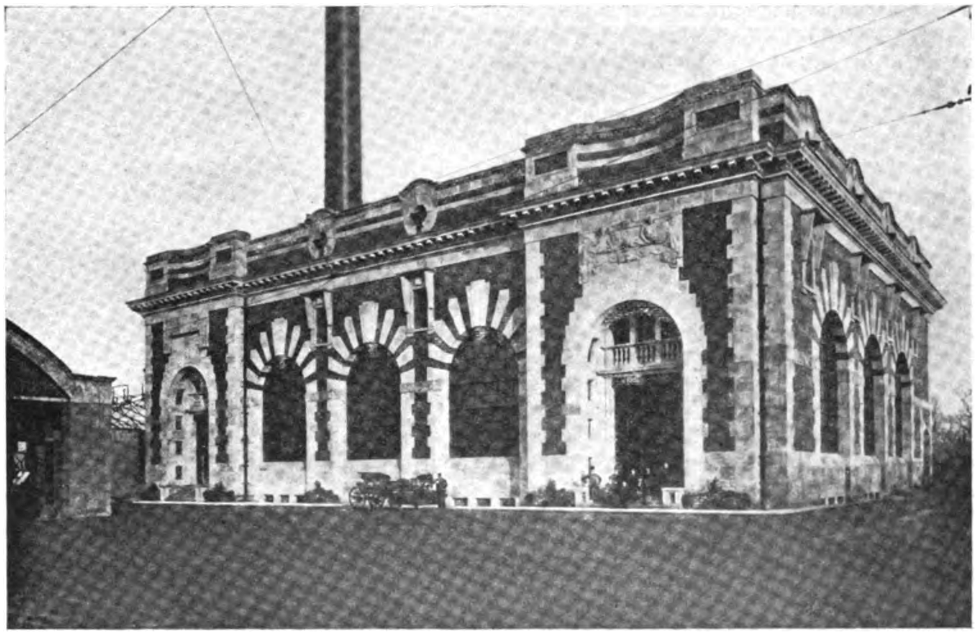
THE July number of "Science Abstracts" contains a short summary of a paper on "Economy of Copper in Transmission Lines," by Mr. Latour, in the course of which he points out that the use of accumulators at the distant end of a line may conduce to economy in the cost of a transmission line in cases where the power is transmitted over comparatively short distances. This is due to the possibility of sending along the transmission line a constant current, which is equivalent to the mean amount of current required throughout the day, or, in other words, to the possibility of maintaining a constant load on the running machinery. He shows that if, under the usual conditions, full load is maintained on the line during eight hours of the day, and there is no load during the remaining sixteen hours, the loss in the transmission line is three times as great as it would be if, with the use of accumulators, it were possible to maintain a steady load on the line equal to the mean load required. It is pointed out that this requires to be somewhat corrected to allow for the fact that the efficiency of the battery is not 100 per cent.; but even allowing for this, the line loss would be much smaller in the one case than in the other. The matter may be put in another way; it is possible to have much less copper in the line in the one case than in the other, and yet have equal daily loss in the line; and consequently, from the point of view of the author, the use of accumulators may be be said to conduce the economy in the cost of copper. No estimate is, however, made of the cost of plant under the two conditions, though it is pointed out that the use of accumulators dispenses with the cost of transformers at the distributing station.



CENTRAL POWER STATION OF THE LONDON UNITED TRAMWAYS COMPANY.

THE ELECTRIC TROLLEY LINES OF LONDON.

Some time last year we described at some length the installation which was being set down in the west of London for the large trolley schemes of the London United Tramways Company, Limited. Since that information was compiled, however, certain alterations in the original plans have been made. The following description of the model power house, which is now in continuous operation, is furnished us by Mr. J. Clifton Robinson, the managing director of the company.

The company's headquarters are situated in High Road, Chiswick, W. Within its extensive property, covering an area of four acres, the company has erected its model power station. The depot is shaped like the letter Y, with the narrow end to High Road.

Where the ground widens to the right of the space facing the car-sheds is seen the splendid building within which the electric power for the entire system, existing and proposed, is created. Of noble design, this stately power house is built of brick, with massive freestone quoins and other adornments.

This handsome building, measuring 154 feet in frontage, has a total depth of 106 feet, divided internally into two main portions—the engine room and boiler room. The internal walls of both these divisions are faced with glazed bricks, and the engine room floor is laid with mosaic tiles.

The boiler room, which occupies the eastern or furthest back portion of the building, consists mainly of a steel frame structure, designed to carry the heavy weights of the coal storage bunkers (which contain 500 tons of coal), the flue, the "economizer," and the feed water tanks, all of which are located on a floor above the boilers. This steel structure extends to the roof, thus making the boiler room practically independent of the engine room.

The equipment in the boiler room consists of ten horizontal water-tube boilers, each capable of evaporating 11,000 pounds of water per hour at a steam pressure of 150 pounds per square inch, with a draft as measured in the main flue equivalent to a column of water three-quarters of an inch in height. The total heating surface in each boiler is 3,140 square feet. Arranged in five batteries of two boilers each, each boiler is fired by a mechanical stoker of the "Coking" type, and these stokers are driven by shafting placed underneath the floor.

The fuel is mechanically delivered from the basement level to the coal bunkers above the boilers. At each end of the building the coal is shot into a receiving hopper, which automatically empties it into a series of buckets on an endless chain, by which the coal is carried to the bunkers above, and tipped automatically into them. This apparatus is capable of handling 40 tons of coal per hour, and is driven electrically by a 10 hp. motor, the driving gear being situated on the top of the bunkers. The conveyor is also used for the removal of ashes by means of a series of buckets running along the basement in front of the ash pits, from which the ashes are taken by the buckets and dumped into an ash bin, which in turn shoots the ashes into a receiver outside the building.

Two vertical compound duplex pumps are located at the north end of the building, each being designed to work against a boiler pressure of 180 pounds per square inch with a normal piston speed of 50 feet per minute. Each is capable of supplying the feed water for 4,000 hp. at 15 pounds of steam per horse power per hour.

The flue is located above the boilers and the gases are taken up to it by breeching pieces. It is constructed of steel plates, and is 150 feet long and 6 feet 3 inches wide, widening in height from 3 feet to 13 feet 6 inches, from which point two branches go to the chimney. These branches are constructed of brick and in one of these is placed the "economizer," containing 360 tubes in one group of 36 sections. This "economizer" is provided with self-acting beveled-edged scrapers and scraping gear driven by an electric motor.

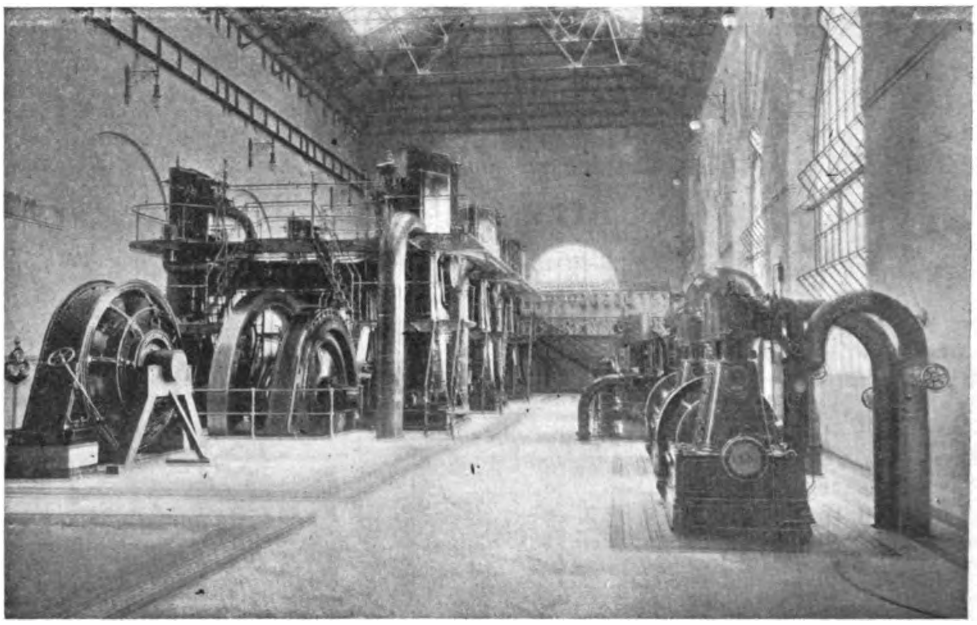
Between the flue and the coal bunkers are placed two feed water tanks, each having a capacity of 6,000 gallons.

The plant for softening the feed water is located outside the building, and is capable of treating 10,000 gallons of water per hour, reducing its water hardness to 5 per cent. on Clarke's scale. It consists of a cast iron tank divided into equal compartments, 19 feet 6 inches by 19 feet 6 inches by 10 feet, with a re-agent tank and a carbonating apparatus.

Water is obtained from three wells, consisting of 6 inch tubes driven down 30 feet and provided with strainers at the bottom. These tubes are 20 feet apart and are connected with an internal pipe 4 inches in diameter, this being connected to a 6 inch main. The wells are capable of yielding 3,600 gallons per hour each, with a water level of not more than 16 feet below the surface; thus 10,000 gallons per hour may be obtained continuously from the three wells.

An electrically driven three throw pump, capable of pumping 50,000 gallons per hour, pumps the water into the water softening tank, whence, after being softened, it is discharged into the reservoir under the cooling towers.

The engine room is 60 feet wide, and a 25 ton electric overhead traveling crane traverses its length of 154 feet. This crane is operated by three electric motors, one for hoisting and one each for the longitudinal and cross transverse motions, the motors being separated by controllers from the platform of a suspended operating cage.



Engine Room of the London United Tramways Company.

There are in the first place two vertical cross-compound condensing engines with cylinders 22 inches and 44 inches by 42 inches stroke, running at ninety revolutions per minute, with a steam pressure of 150 pounds at the throttle. Each of these engines is directly connected to two 250 kw. compound-wound continuous-current generators, one placed on each side of the fly-wheel. The diameter of the shafts of these engines is 22 inches, and the fly-wheels, which are built up in segments, weigh 36 tons each. The variation in speed does not exceed 2½ per cent. from no load to full load. These engine sets are used for supplying current to the lines in the vicinity of the power station, and in addition there is now one 500 kw. to be increased afterwards by two 1,000 kw. three-phase sets for the transmission of power to the sub-stations. These latter run at 94 revolutions per minute and to each is directly coupled a 5,000 volt, 32 pole, 3 phase alternator, the frequency being 25 cycles per second. These generators are of the revolving field type, the fields consisting of a cast steel ring of high permeability, with outwardly projecting poles of sheet iron bolted through the rings to the spider, which is keyed to the shaft. The fields are excited from the continuous current bus-bars at a pressure of 500 volts.

In the engine room are also located two lighting sets, each consisting of a two-crank tandem compound high-speed vertical engine coupled to a 75 kw. compound-wound continuous-current 500 volt generator, running at a speed of 400 revolutions per minute. These provide electric light for the offices, car-sheds and works generally, and also provide current for the various motors used for power in the machine shops, etc.

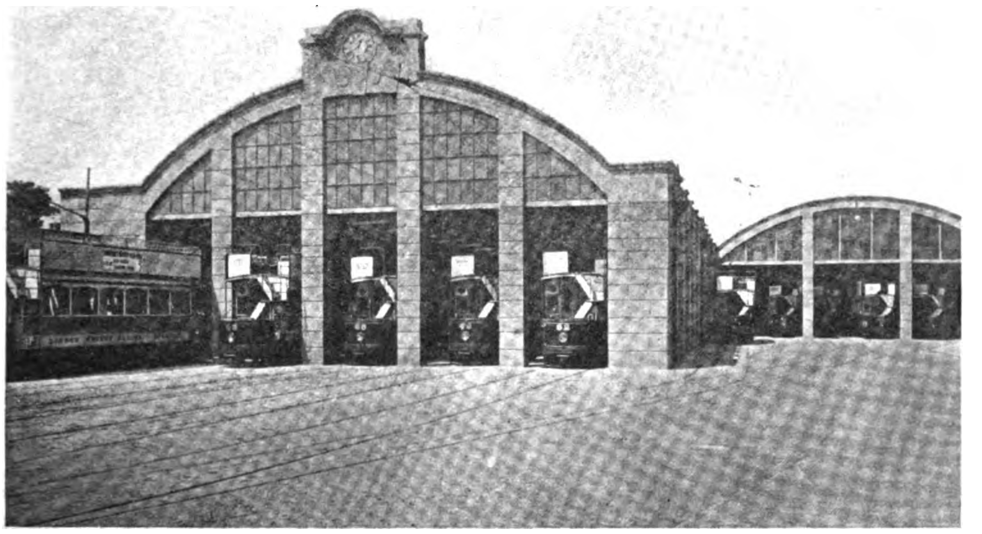
There are also two 15 kw. boosters for use in connection with the rail return. These boosters are motor driven and run at a speed of about 1,000 revolutions per minute. The generator is designed and constructed as a series machine for proportional excitation, and, with a current of 300 amperes, the potential difference across the armature is 50 volts. The fields of the boosters are connected in circuit with the out-going feeders and the armatures to the track return and the negative bus-bar, so that the amount of boosting is proportional to the amount of the outgoing current. For further regulation a shunt-regulating rheostat is provided.

The engine room also contains one 250 kw. rotary converter, similar to those installed in the sub-stations. This is installed in the engine room for two purposes. It will either be operated for transforming alternating current to continuous current, so as to assist in supplying current to the lines in the vicinity of the power station, or it may be used to assist the three-phase generator; i. e., it may be driven as a continuous-current motor, generating alternating current which will be stepped up to 5,000 volts and then transmitted and transformed at the sub-stations. For operating the rotary as a three-phase generator in the manner indicated a separate exciter is provided. This exciter consists of a series generator driven by an induction motor connected to the three phase side of the rotary. This arrangement provides a compensating field and prevents variations in the speed of the rotary from variations in the speed of the load. The transformers used in connection with this rotary are placed in the engine room basement.

The condensing apparatus is also located in the engine room and consists of two surface condensers each containing 3,200 square feet of cooling surface, and each provided with a separate combined air and circulating pump of the vertical cross compound duplex-acting type, with steam cylinders 8 inches and 15 inches and air and water cylinders 20 inches and 15 inches stroke. The exhaust from the main engines may either be taken to the condensers or to the atmosphere, passing through an automatic exhaust valve. The condensers are so arranged that any one or more of the main or lighting engines can be connected to either condenser.

Cooling towers are provided for condensation. These are of the twin type, arranged in three sections, covering a ground space of 40 feet by 15 feet by 38 feet high, and having a capacity for dealing with 6,000 hp. The mats composing the cooling surface consist of galvanized iron wire netting and a proper distributing system for the water over these mats is provided. Air propellers are provided for each section, operated at 160 revolutions per minute by an electromotor, in the engine room the shaft extending through the wall to the fans. The condensing apparatus is capable of maintaining a vacuum of 25 inches under all atmospheric conditions.

The basement under the engine room contains nearly the whole of the steam, exhaust and water pipes, together with the hotwell, pumps, feed water filters, and feed water heater. The hotwell, to which the air pump discharge is taken, consists of a cylinder 48 inches in diameter by 96 inches long. The feed water is taken from this, and then pumped by two motor driven triplex pumps through the filters into the tanks above the boilers. The piping is so arranged that the feed water may be pumped from these tanks either through the feed water heater or through the economizer, through both, or direct to the boilers. The feed water heater has a heating surface of 520 square feet, the exhaust from the lighting engines and the boiler feed pumps being available for heating the water.



CAR SHED OF THE LONDON UNITED TRAMWAYS COMPANY.

The switchboard is erected at the south end of the engine room, upon an ornamental gallery 9 feet from the floor level. It consists of white marble panels 7 feet 6 inches high by 2 feet wide, bolted to angle iron frames, there being 27 panels in all. The board extends practically the whole width of the room, one half being for the continuous-current panels and the other for the three-phase panels. The continuous-current board consists of 4 railway generator panels, 2 booster panels, 8 feeder panels, 1 Board of Trade panel, and 1 instrument panel. The high tension board contains 3 three-phase generator panels, and 8 three-phase feeder panels. The switches and bus bars for the high tension current are supported by joists in a closed chamber underneath the switchboard floor, the switches being of the oil break type, and operated through levers on the switchboard. In addition to this main switchboard there is a lighting switchboard underneath the main gallery, consisting of 2 lighting and 2 power circuit panels, together with 2 panels for operating the rotary converter above described.

The extensive sheds at the depot are capable of accommodating 100 electric cars, and a complete series of repairing shops has also been provided. The sheds, which contain eleven lines of track in all, are furnished with pits for inspection purposes, and all the movements of the cars to, from and within the sheds and shops are effected electrically by the trolley wires.

The machine shop is provided with woodworking plant and machine tools for car repairs. They are driven by underground shafting by a 30 hp. motor located in the pit. This part of the shop is also well furnished with carpenters' benches.

The north end of the structure is devoted to the repair of the motors and car trucks, and is provided with various iron working machines. These are driven by a 20 hp. motor, and there are also two smiths' hearths, supplied with draught from a centrifugal fan driven by a 5 hp. motor, which also drives an emery grinder for dressing castings. At the north end is an electric traverser, working over the tracks in the shop and over three tracks in the running shed. The pits are provided with hydraulic jacks for removing the motors, and a 3 ton overhead traveler is also provided for lifting purposes. As all the motors in the repairing shop and throughout the depot generally are controlled by automatic switches, they can be operated by the men without risk.

Practically the whole of the overhead lines are carried out on what is known as the "span wire system."

The trolley wire is hard-drawn copper wire of No. 0 B. & S. gauge, having a conductivity of 98 per cent. of Matthiessen's standard of pure copper. While the system generally is constructed with span wires, there is a special example of center pole construction through Ealing, and in Southall-Norwood, Uxbridge Main Road, side bracket suspension is introduced. The trolley wires throughout are suspended at a height of not less than 21 feet from the ground, except of course under the railway bridges, in which case they are splayed out and are protected by a wooden troughing. The entire route is divided into half-mile sections to meet the requirements of the Board of Trade, and at each half-mile section two section boxes are provided. This constitutes one of the most distinctive features of the system, as each trolley wire has its own feeder and distributer, and each of these can be disconnected at these section boxes. The distribution is thus duplicated throughout, forming an ideal system, providing against breakdowns either in the cables or the overhead equipment.

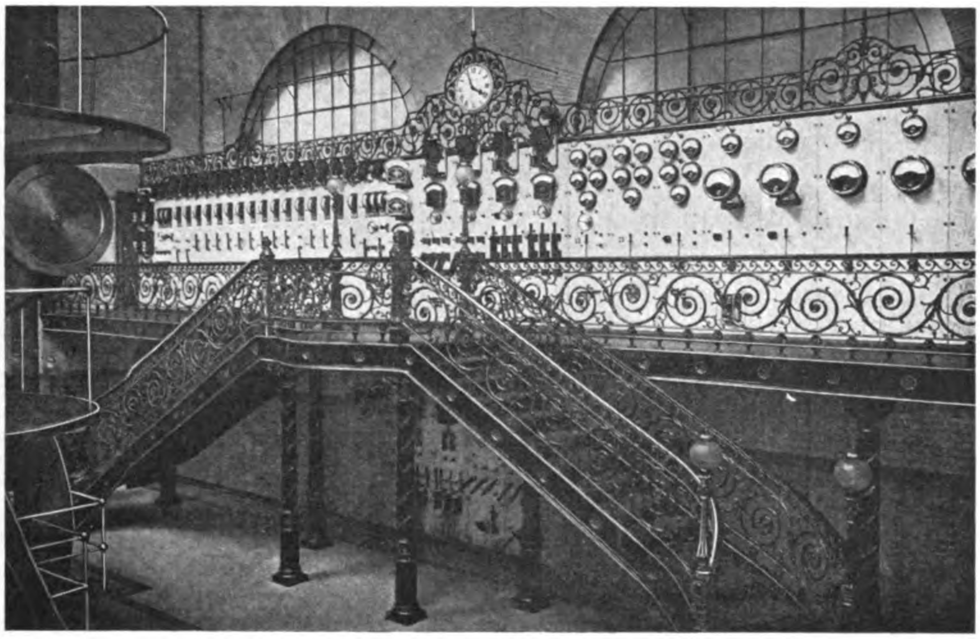
The electric current is carried for distribution over the system by means of lead-covered paper-insulated cables, drawn into wrought-iron cement-lined ducts laid under the footpaths or between the tracks. As many as 42 of these ducts radiate from the central power station. The pipes are laid to a minimum depth of 18 inches from the surface of the roadway to the top of the concrete, and they run as straight as possible from manhole to manhole. They are laid on a bed of concrete not less than three inches thick, composed of Portland cement, one part; clean, sharp sand, three parts, and broken stone, five parts. This concrete is mixed as required and used fresh, and allowed to stand until it acquires its initial set. The lengths of pipe are properly fitted together with a Portland cement fillet, gauged neat, turned round and over all the joints. Each layer of pipes is covered and completely surrounded with concrete, extending three inches on each side.

As before mentioned, the whole of the feeding arrangements are duplicated. There are two distributers running throughout the entire system, each of .2 square inch section, and connected in at every half-mile section, being thus in parallel with the trolley wires throughout. In addition to this the feeders are tapped to the distributers at approximately every one and a half miles, and earth return cables, of .5 square inch sectional area, are connected to the tracks in the middle of Brentford and on the Acton line. These returns are connected to the booster in the station, and the lead covering of the whole of the cables is bonded to the manholes and to the rails throughout the entire system.

The system now open consists almost entirely of double track, and the rails are of steel, of the very best quality, made from first-class ores. The weight of the rails is 92⅛ pounds per lineal yard, and they are rolled in 36 feet lengths. The bed on which the rails are laid consists of concrete 6 inches thick, composed of seven parts Thames ballast and one part Portland cement. This is then covered with a floating of sand and cement, 1 11-16th inches thick, on which are laid the wood blocks, the joints being afterwards run in with pitch. The sand and cement floating is composed of four parts clean sharp sand and one part Portland cement. The fish-plates are also made from steel of the very best quality, and are very tough, with no brittleness, the bars being rolled from blooms of sufficient sectional area to secure this. The weight of a pair of fish-plates is 92⅛ pounds. The rails are double-bonded throughout. At every joint there are two copper bonds of 0000 B. & S. gauge, with cross bonds every 40 yards.

The tramways are paved throughout with hard wood Jarrah blocks, tar grouted and top-dressed with Portland cement.

The lines through the Hanwell and Hounslow districts are fed by currents transmitted from the central power station in the first instance at a pressure of 5,000 volts. The substations from which the current is then locally distributed are situated some distance apart, each being approximately five miles distant from the central power station. The current is transmitted to them by 3-core cables, each core having a sectional area of .05 square inch. In each of the sub-station buildings there is provided a rotary converter room and a transformer room. The equipment meantime consists of two rotary converters and seven transformers, together with the necessary switchboards. The



Switchboard Gallery of the United London Tramways Company.

rotary converters have a full load rating of 250 kw., at a voltage of 550 volts, and at a speed corresponding to 25 cycles per second. The rotary converters are interchangeable, and are capable of over-compounding from 500 volts at no load to 550 volts at full load, and are also capable of withstanding 50 per cent. overload without sparking and with the brushes in a fixed position, and 100 per cent. overload without surging or falling out of synchronism.

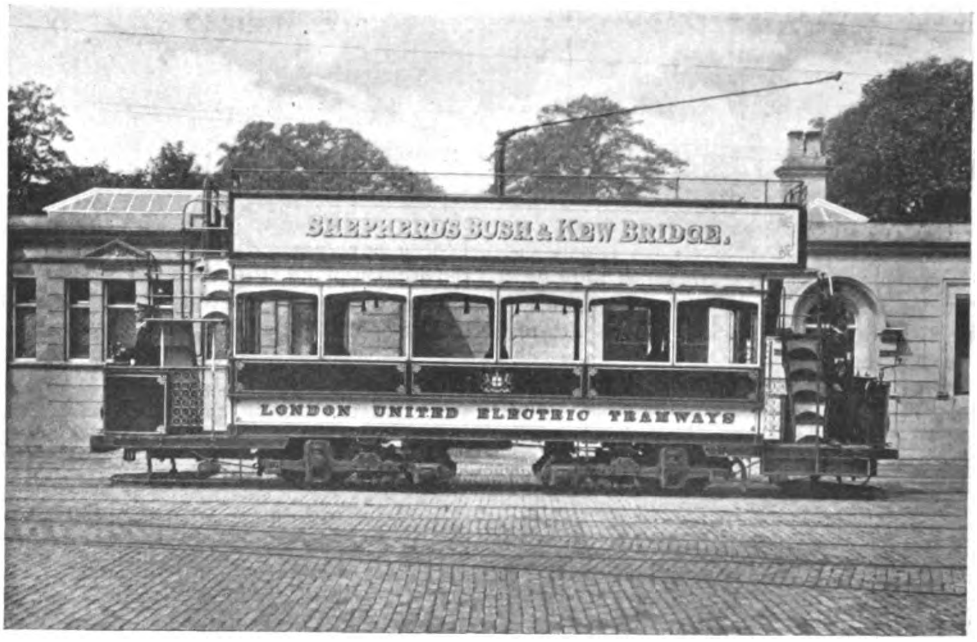
Each rotary has directly coupled to its shaft a 15 kw. booster, the magnet frame of the booster being carried on a bracket cast on the base of the rotary. These boosters are run as separately-excited generators, and arrangements are made to connect the fields in circuit with any one or more of the main feeders, whilst the armatures are connected in series with the return feeders, the further end of the feeder being connected to a distant point in the track. Each booster is provided with a field rheostat connected in shunt across the field. A small induction motor is provided for starting the converter.

The transformers are of the oil type, having a full load rating of 100 kw., with a secondary voltage of 330 volts and a frequency of 25 cycles per second. The impressed voltage on the high tension side is 5,000 volts, and the corresponding secondary voltage may be either 310, 330, or 350 volts, three leads being brought out to a terminal block fixed on the transformer, and having a switch for connecting to any of the terminals. The transformers are grouped in sets of three, and are connected on the Delta system, one being spare.

In each sub-station there are switchboards for the high-tension and the low-tension currents. The high-tension board consists of five panels, there being two feeder panels and three high-tension transformer panels. The low-tension board consists of thirteen panels, there being three rotary converter panels, two meter panels, two booster field panels, two booster armature panels, two traction feeder panels, one Board of Trade panel and one spare panel. The booster field and armature panels, and also the traction feeder panels, are arranged as plug boards, and it is possible to plug either booster on any main feeder or return.

At each of the sub-stations there are commodious car sheds and offices, each car shed accommodating 50 cars. In each case pits are provided between the tracks for inspection purposes.

Rolling stock of a superior model has been specially designed for this system. Each car



Shepherd's Bush and Kew Bridge Car, London United Tramways Company.

is mounted upon two four wheeled bogie trucks, and is equipped with two 25 hp. electro-motors, weighing 1,480 pounds each, and each capable of exerting a horizontal effort of 1,270 pounds on a 30 inch car wheel at a speed of eight miles per hour. There are seats for 69 passengers, 30 inside and 39 outside.

The controllers and other electrical apparatus on the cars are of the most advanced type, and electric light is provided for interior lights, as well as for the powerful head-lights recessed in the dashboard at each end of the car.

The controllers are of the series parallel type embodying the magnetic blow-out principle. The main or power cylinder and the reversing cylinder are interlocked so that the power handle cannot be operated, or the car moved, except when the reversing handle is set either to run forward or backward. When the reversing handle is in the middle position the power cylinder is locked. Electric braking is effected by the controller connecting the motors as series generators and in series with same resistance as used for starting the cars; and this resistance is gradually short circuited by the successive points on the brake side of the controller. The current required for braking is therefore derived from the motors acting as generators and is altogether independent of the trolley wire. The brake-power thus at command, entirely apart from the ordinary brake-power on each car, gives to the conductor immediate and full control over his car and from the public point of view is of great importance. An emergency stop can be effected, at any speed, much within the car's own length.

Already the scheme which is constantly being extended, has involved a capital outlay of no less than £1,000,000 sterling, and one remarkable feature remains to be noticed. The whole of the work, structural, out-door, architectural and technical, has been designed and carried out by the company and its staff, no outside aid being employed, nor has any contractor been engaged either for building or out-door construction. The engines and dynamos and other technical details were purchased from the manufacturers, on the specification in each case prepared by the company's engineers.

Mr. Horace F. Parshall is the consulting engineer, and, as we have said, Mr. J. C. Robinson is the managing director.

This description is of special interest as it shows the very latest tramway work done in England.

PAN-AMERICAN SCENES AND EXHIBITS–V.

BY FRANK C. PERKINS.

After passing the Triumphal Causeway toward the Electric Tower, the view which greets one's eye on looking toward the left, is that seen in illustration, Fig. 1. The Horticultural Building is noted in the background at the left with the West Esplanade Fountain in front with its beautiful flower beds and artistic groups of statuary. The Temple of Music at the right with the fountain of abundance in the foreground is acknowledged by all to be the most exquisite in color and artistic staff work. The next large building on the left passing the Cascades toward the Court of Fountains is the Machinery Building, illustrated in Fig. 2, with the fountain basin in the foreground. In this building are many exhibits of interest to the electrical engineer, including the automobile exhibits, showing electric, steam and gasoline power applications, as well as numerous electrically operated machines.

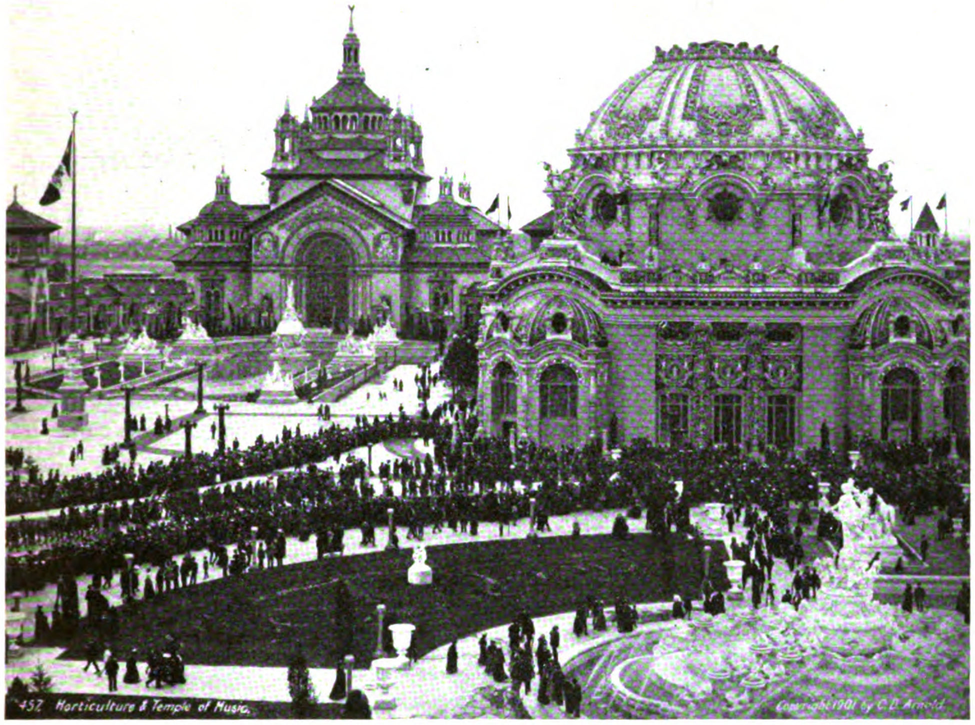

452 Horticulture & Temple of Music.
Copyright 1901 by C.D. Arnold

FIG. 1.

Temple of Music and Horticultural Building, Pan-American Exposition.—Fountain of Abundance in foreground at right and Esplanade Fountain Basin in background at the left.

The Fountain of Man, shown in Fig. 3, is excellently designed as are most of the numerous fountains in the Court of Lillies and Court of Cypresses, but the general criticism is only too true, that the floating electric lamps in the flowers of these basins as expected are very slow in making their appearance, but it is said they will soon be installed. The electrical exhibit illustrated this week is that of the Kellogg Switchboard and Telephone Pavilion. A complete line of subscribers' wall and desk instruments for both magneto and centralized energy systems are shown. Two booths are used, the main exhibit being in Section R and a branch exhibit in Section F of the Electricity Building.

A complete telephone exchange is to be seen, with centralized battery, lamp line signal, double lamps, supervising signals in cord circuits, and switchboard.

The ultimate capacity is 3,000 with a present capacity as shown of 1,080 lines. A number of wall and desk instruments are connected to this board to show operation. This exchange includes a complete power plant in duplicate, storage batteries, main and intermediate distributing frames and relay racks. The switchboard is located in an "exchange room" in the main booth, and the power plant, etc., in a basement under the main booth.

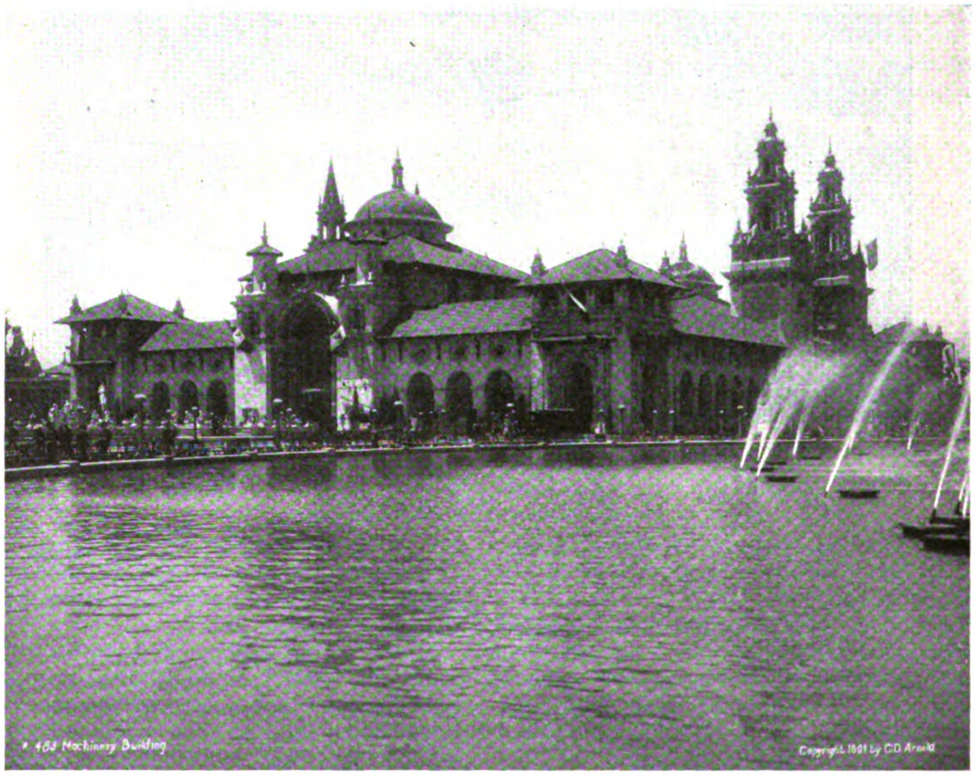


FIG. 2.

Machinery Building, with Electric Tower Fountain Basin in foreground, Pan-American Exposition.

A combination centralized battery and magneto switchboard is exhibited with 160 C. B. lines and 30 magneto lines. The cord circuits on this board are arranged for interconnecting centralized battery lines, magneto lines and centralized battery lines with magneto lines.

The two-division centralized battery lamp signal switchboard shown is particularly interesting. The subscriber is provided with two push buttons so as to be able to make direct connection with either division of a two division multiple switchboard—thus making it possible to connect directly with subscriber desired without use of trunk lines between subscribers.

The wall type switchboard on exhibit has 20 magneto lines and has apparatus for four party selective signaling.

A section is shown of a 12,000 line straight multiple switchboard, with centralized battery lamp signal, double lamp supervisory and jacks mounted forty per strip. This is claimed to be the largest lamp signaling multiple board ever made. There are also in this exhibit four express type switchboards ranging from 50 to 200 lines capacity, of the magneto type, and having self restoring drops.

THE NEW TRUNK EXCHANGE NO. 1 BERLIN.*

The new Berlin Trunk Exchange, which has been recently installed, and at which it is intended to deal with the whole trunk wire traffic of that city, has been fully described by Herr Lindow in the "Elektrotechnische Zeitschrift," and presents many points of novelty and interest. The office has been fitted up with the most modern apparatus at a cost of about £62,500, and has a capacity of 10,600 subscribers' lines and 1,600 outgoing local and sub-exchange junctions. The lines are brought into the exchange partly overhead and partly underground. The overhead bare wires are led down in 28-wire india-rubber lead-covered cables from the iron derrick on the roof to the fuse protectors directly underneath. The latter are mounted in sets of seven on porcelain plates, and offer a protection against currents up to 500 volts. From these protectors 28-wire asbestos cables run to the switch room, where they terminate in lightning protectors which are fitted on an iron frame and arranged for 56 lines—two cables to each lightning protector. The wires are continued from the lightning protectors to the principal distributer in similar cables.

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*From the "Electrical Review," London.

The lines which are brought into the exchange underground are partly in single-wire paper-insulated cables of the old form and partly in 56 and 112 pair cables of modern construction. The cable heads are arranged in two rows, one over the other, on special iron frames. They are connected with the principal distributer by means of 28 wire or 28 pair asbestos cables.

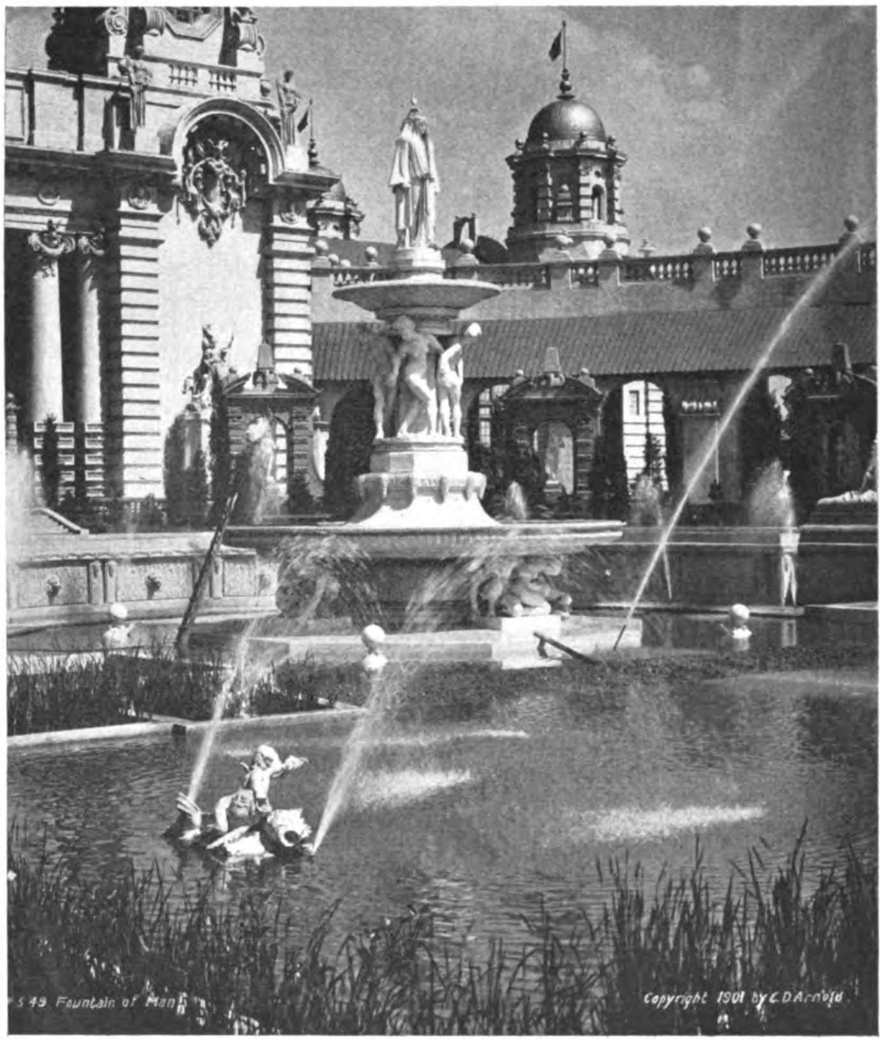


Fig. 3.

Fountain of Man, Pan-American Exposition.

The principal distributer is constructed of tubular posts connected with each other by flat bar iron, and forms a sort of horseshoe-shaped arbor. A casing of stout sheet iron, 80 cm. wide and 30 cm. deep, for the reception of the "system" cables leading to the apparatus, runs along the top of the arbor. The terminals, to which the cable conductors from the lightning protectors and cable-heads and those leading to the apparatus are connected, are fitted in two rows on ebonite strips which are arranged vertically on the sides of the distributer. The connection of the line terminals with the terminals on the apparatus side is effected by means of asbestos wire which is threaded through oval loops. From the apparatus terminals of the ebonite strips, 42 wire cables are run to the first multiple switchboard.

These cables are insulated with silk and cotton, and consist of 42 single tinned copper wires, 0.6 mm. in diameter. Each wire is first double covered with silk, then 20 are covered over the silk with white, and 20 with red and white cotton, whilst one of the remaining wires is covered with red and the other with blue cotton. Each pair always consists of a white and a red-white wire, or of the red and the blue wires. The wires are stranded up into a cable, which is then covered successively with cotton yarn, prepared tape and a braiding of cotton, and is finally impregnated with a flame-proof compound. Such a cable is connected to a strip of 20 multiple jacks, leaving one pair of wires spare.

There are altogether 37 switchboards or tables, of which the right-wing and center each contain a single row and the left wing a double row. The multiple boards for the subscribers' lines and for the local and sub-exchange junctions are of the table form, and were supplied by Stock & Co., of Berlin. Ten tables are intended exclusively for subscribers' lines, and of the remainder half are to be used for subscribers' lines and half for junctions.

Each half of a subscriber's board has in front 200 drop-indicators, 200 answering jacks divided into 5 panels, 45 connecting sets (two pegs with cord and weight, one lever switch, and one indicator for the clearing signal) and three answering sets (one microphone and telephone, and one key). The subscribers' lines, arranged on the two-cord system, are distributed to three positions, and each operator is able with this system to assist on the positions on each side of her. The multiple jacks are common to both sides of the table. The answering jacks are fitted in the peg-board, and the multiple jacks in the central part of the table; the surfaces of the strips on which the latter are mounted are roof-shaped, and are furnished with numbers on each sloping side, which can be read from the operator's position on each side of the table.

The cables used for connecting the jack-strips of the multiple switchboards, and also the "return" cables for connecting the last jack-strips with the drop indicators contain 63 wires, insulated with silk and cotton; 20 wires are white, 20 red and white, and 20 blue and white, the remaining three being respectively, red, blue and yellow. The blue and white wires are used as test wires. The cables are made up in the same way as the 42-wire cables previously described. There is one cable to each jack-strip, leaving three wires spare. They are placed on the hooks of rack-like supports, which are suspended pendulum fashion from the iron frame of the switchboard underneath the multiple jacks. This plan admits of a compact and easily-inspected arrangement of the cable, and even when the jack space is fully fitted, any cable may be lifted out by hand, either from above or below. The cables are led up from the chasings to the first switchboard through an annex or "dummy" part of the board, which at the same time serves as a writing table for the supervising officer.

The drop indicators are of the usual construction. The armature of the indicator electro-magnet is supported by two screw-points at the back, and carries a long arm, the hooked end of which engages the upper edge of the shutter. If the armature is attracted, the arm is lifted and the shutter released. The shutter, which is also pivoted on screw-points, turns through 90°. The armature has no retractive spring, but falls back into the normal position by its own weight. The adjustment of the amount of play is effected by means of a brass screw passing through the armature. The electro-magnets are arranged side by side in metallic frames in sets of 10. The indicator coil has a resistance of 140 ohms. For night service the indicators are provided with a contact and a spring. When a shutter falls the spring is lifted against the contact, and closes the night-bell circuit. The latter is arranged as follows: A special self-restoring indicator is provided for each half of the switchboard, which, if any indicator on the board falls, also falls at the same time. The falling of this indicator shows on what board the call has been received. There are altogether 88 of these indicators, arranged in two groups of 24 each and one group of 40. They are placed on the dummy parts of the switchboards. The indicators are large (4 × 5 cm.), and can be recognized without difficulty from opposite ends of the series of boards.

When a fallen indicator is restored on one of the multiple switchboards, the corresponding indicator on the night bell board is at the same time automatically restored. The bell belonging to any night indicator board can be cut out if required.

The operator's set, consisting of the usual breast-plate transmitter and head telephone, may be joined up for use on the multiple switchboard by means of a twin plug and special jack.

The diagram shows the connections for two subscribers' lines (one double and one single) in accordance with the two-cord system employed. The subscribers are put through by means of special pairs of pegs connected with each other by conducting cords. According to the position of the speaking (listening) key the subscribers are put through direct, or with the speaking set in circuit. The whole of the lines pass through the multiple jacks of all the switch sections before they reach the answering jacks and indicators, so that when a connection is made the indicator is always cut out. The system will be best explained by describing the process of putting a subscriber through.

The current from the subscribers' line will pass through the multiple jacks (*k*) of all the sections, then through the answering jacks *ka* and the indicators *kl* either to earth, in the case of single lines, or through the *b* line back to the calling subscriber in the case of double lines. The shutter *kl* drops, and on seeing this signal the operator inserts the answering peg A S of one of her cords in the answering jack *ka*, thereby cutting the circuit through the electro-magnet, and if the key U is in the speaking position, establishing a new path for the current through the battery key B *t*, the telephone F, and the induction coil J of the microphone circuit to earth, or to the *b* wire of a double line. The microphone battery remains in circuit so long as the operator's set is joined up. When the originating subscriber has given the number of the required subscriber the operator tests if the wire is engaged by touching the socket of the corresponding multiple jack with the tip of her calling peg, holding her listening key meanwhile in the speaking position. If the line is engaged a click will be heard in the telephone. The electrical operation is as follows: The sockets of all the multiple jacks belonging to a subscriber's line are connected with each other by a "test" wire. By the insertion of a peg at any one of the operator's positions this test wire will be connected with the negative pole of a test battery whose positive pole is to earth. If now the tip of a calling plug at one of the other positions makes contact with the socket of a jack connected with this test battery, the latter will send a current through the battery key B t_2, the induction coil J, one-half of the coil of the telephone, F, and the graduator, *g* (of 600 ohms resistance), to earth. If the line is disengaged no circuit will be formed through the jack socket to earth and no click will be heard. To connect the calling subscriber with the required subscriber the calling peg, V S, is then inserted in the latter's jack, and the lever of the speaking key is pushed back (towards the right in the figure), thereby placing the two lines in immediate connection with each other. The clearing drop, S K, is permanently connected in bridge across the two wires of the peg, A S.

Should it be necessary to call up a subscriber from the exchange a peg is inserted in his jack, the speaking key, U, is pulled forward (towards the right in the figure), and the key, B *t*, depressed. A magnet giving an electromotive force of 26 to 28 volts supplies current to all the positions. The armature is driven continuously by a small electromotor. The fall of the indicator, B *k*, whose electromagnet has a resistance of 140 ohms, indicates that current from the generator has passed out.

Special devices have been devised for detecting disturbance on wires. The pole of the generator, which is connected when calling with the *a* wire of the line, is extended to a free multiple board, and is there connected with a metal bar to which also single conductor cords are attached, the pegs of which are cut off so short that when they are inserted in a jack they only make contact with the socket, and do not touch the springs. If there is disturbance on a line, one of these pegs is inserted in the jack socket corresponding to it. Then at all the operators' positions, on making the engaged test on this wire, the rattle of the generator will be audible. This arrangement enables the testing officers, after removing a fault, to call up the exchange on the same wire, and cause the latter to be restored.

The junction wires between Exchange 1 and the other exchanges in Berlin are worked as incoming and outgoing lines—that is, they are used exclusively either in the direction from the central exchange to the sub-exchanges, or from the latter to the central exchange. The somewhat simpler single cord system is applied to these lines. The outgoing junctions are connected with jacks, whilst the incoming junctions do not, like the subscribers' lines, pass through the whole of the multiple switch-

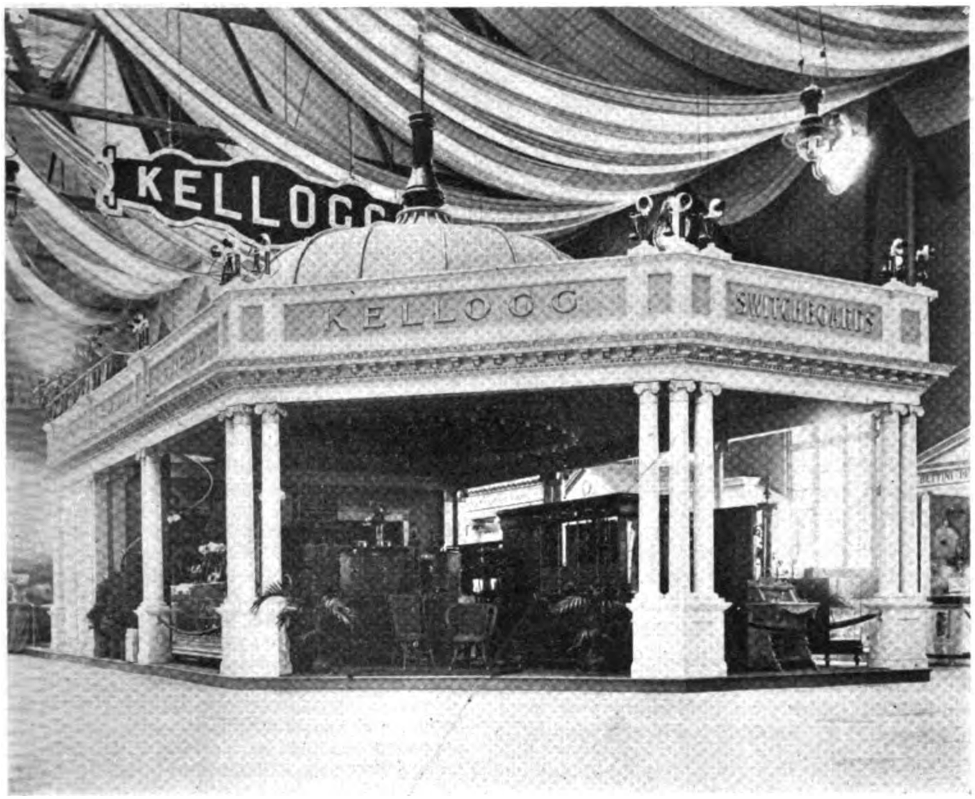
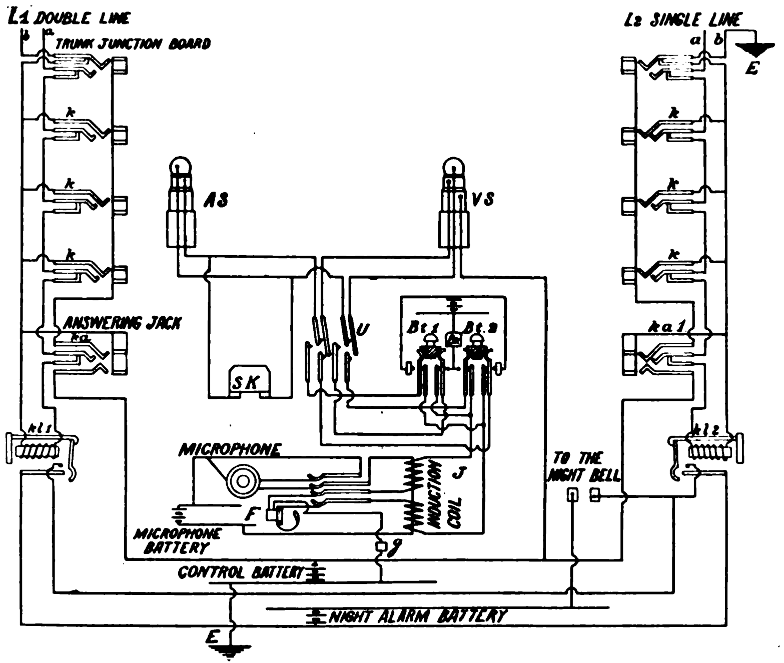


FIG. 4.
Kellogg Telephone Company Exhibit in Electricity Building, Pan-American Exposition.



boards, but are directly connected with the indicators. The exchange has been arranged to take 1,600 outgoing and 1,485 incoming junctions. Each half switchboard is capable of receiving 45 incoming junctions distributed over three positions, but there are actually only 10 wires connected to each position.

Each junction line is permanently connected with a two-wire cord. The line is led directly to a speaking key. On pushing back the lever of this key the line will be directly connected with the peg, on pulling it forward the speaking set will be placed in bridge across the line. The calling indicator, which at the same time acts as a ring-off indicator and the arrangement of which corresponds to the ring-off indicators in the subscribers' lines, is permanently bridged across the *a* and *b* wires of the junction. The test for ascertaining whether the subscriber's line to be connected with the junction is engaged or not, and the connection of the junction with the subscriber's line is effected in the same manner as in the case of two subscribers' lines.

Accumulators are used in the exchange, and are arranged in boxes of four. The cells—on the Böse system—have an electromotive force of 2 volts each. For supplying the microphones of the exchange, a common battery consisting of four boxes is used, the cells of which are joined up in parallel. Instead of connecting the microphone separately with the poles of the battery, copper strands are attached to the bars of the switchboard in which the battery leads terminate, and are run along the switchboards. The microphone leads are teed off from these strands. To prevent induction between the various operators' positions, the resistance of the copper strands has been made very low. Each consists of 19 tinned copper wires of 1.5 mm. diameter, and has so small a resistance that no appreciable variation occurs in the currents supplied to the microphones. The ends of the strands, which are well insulated, are looped back to the battery bars.

An accumulator cell is used for the test battery, and one of 2 volts electromotive force is also used for the control clock on the junctions.

BOOKS RECEIVED.

Theoretical Elements of Electrical Engineering. By Charles Proteus Steinmetz. Published by "Electrical World and Engineer," New York. 320 pages. Illustrated. Price $2.50.

As stated by the author in the preface this work leads up very gradually from the ordinary sine wave representation of the alternating current to the graphical representation by polar coördinates, from there to rectangular components of polar vectors, and ultimately to the symbolic representation by the complex quantity. The work is broad in its scope, in so far as it comprises the fundamental principles not only of alternating but also of direct currents.

Engineering Practice and Theory. By W. H. Wakeman, New Haven, Conn. Price $1.

This little work, which is neatly gotten up, contains 170 pages of reading matter, and should certainly be in the hands of every central station engineer. As the author states the work is intended for men in charge of steam plants who wish to improve their knowledge of steam engineering in order to enable them to pass examinations where a license is required, and to do more satisfactory work wherever a steam engine is found. The matter is fully illustrated and the theory is explained in so simple a manner that it may readily be understood by a person equipped only with a common school education.

Induction Coils. By H. S. Norrie. Published by Spon & Chamberlain, New York. Price $1.

This work is fully illustrated and contains some 265 pages of matter referring to Rhumkorff, Tesla and medical coils, Roentgen radiography, wireless telegraphy and practical information on primary and secondary batteries. The various methods of constructing coils are illustrated and explained, as well as their application.

Nature Miracles. Vol. III. Electricity and Magnetism. By Elisha Gray, Ph. D. LL. D. Published by Fords, Howard, & Hulbert, New York. Price 60 cents.

In this volume, which contains some 250 pages of matter, the author begins at the beginning, and gives a succinct history of the science of those two closely interrelated forces, neither of which was of great practical value to the industrial world (except the magnetic needle in navigation) until it was discovered that magnets could be made by electricity, after which the use of the two forces together has advanced by leaps and bounds, so that men dare not prophesy any limit to their practical applications. Among the many amusing anecdotes Professor Gray gives in these familiar talks is one of a college professor of physics, less than fifty years ago, who, after having in an hour's time taken his class through a course in electricity, said: "Gentlemen, you were born too late to witness the development of this great science."

COMING ELECTRICAL EVENTS

American Institute of Electrical Engineers--General Meeting, Buffalo, N. Y., August 20-24.

American Street Railway Association—Convention, New York City, October 9, 10 and 11.

American Electro-Therapeutic Association--Buffalo, N. Y., September 24, 25 and 26.

Association of the Edison Illuminating Companies—Meeting, September 10.

International Association of Municipal Electricians—Convention, Niagara Falls, September 2, 3 and 4.

Ohio Electric Light Association—Convention, Put-in-Bay, August 20, 21 and 22.

Old-Time Telegraphers' Association and U. S. Military Telegraph Corps—Convention, Montreal, September 11, 12 and 13.

Pennsylvania State Street Railway Association—Convention, York, Pa., September 4.

Roentgen Society of the United States—Meeting, Buffalo, N. Y., September 10 and 11.

INCORPORATIONS.

The St. Mary's Electric Company, St. Mary's, Pa. Capital stock, $5,000.

The Colusa Gas & Electric Company, San Francisco, Cal. Capital stock, $100,000. Incorporators: John Martin, Fred H. Pierson, H. U. Roeding, H. R. Noack and William M. Pierson.

The Beaumont Light, Heat & Electric Motor Power Company, Beaumont, Tex. Capital stock, $100,000. Incorporators: W. H. Pope, T. W. Shepherd, S. D. Cooper, I. D. Polk, of Beaumont, and M. A. Orlopp, of New York.

The Yellville Electric Light & Power Company, Yellville Ark. Capital stock, $50,000. Incorporators: W. F. Cleveland, John F. Pitt, J. E Lemen, Alf Wingate, J. M. Emmert, Ezra Willard, Nelson T. Spoor, Harry F. Hunter, Otto A. Metz and Andrew J. Moffett.

The Gainesville Power & Light Company, Gainesville. Ga. Capital stock, $100,000. Stockholders: F. L. Murray, Chicago, Ill., J. J. Spaulding, Atlanta; S. C. Dunlap, Z. T. Castleberry, H. H. Dean, Howard Thompson and E. E. Kimbrough.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUGUST 6, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

679,953. Trolley-Wire Hanger. Albert D. Crossley, South Norwalk, Conn. Filed Dec. 20, 1900.

680,178. Street-Car Fender and Brake. Thomas M. Sanderlin, Norfolk, Va., assignor of one-half to George P. Hudson and Asher J. Hudson, same place. Filed March 23, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

679,803-679,926. Manufacture of Filaments for Incandescent Electric Lamps. William L. Voelker, London, Eng., assignor to Theron Clark Crawford, Arrochar Park, Borough of Richmond, New York. Original application filed July 30, 1900. Divided and this application filed Nov. 19, 1900.

679,877. Electrode for Arc-Lamps. Hugo Bremer, Neheim, Germany. Filed Nov. 13, 1899.

679,878. Electric-Arc Lamp. Hugo Bremer, Neheim, Germany. Filed July 16, 1900.

679,930. Cord-Adjuster for Electric Lamps. George Webster, Christiana, Pa. Filed Jan. 17, 1901.

680,082. Electric-Arc Lamp. Henry Stenz, Chicago, Ill. Filed Dec. 3, 1900.

ELECTRICAL MACHINERY AND APPARATUS.

679,812. Method of Regulating Double-Current Dynamo-Electric Machines. Joseph L. Woodbridge, Cambridge, Mass. Filed June 19, 1899.

679,813. Means for Regulating Double-Current Dynamo-Electric Machines. Joseph L. Woodbridge, Philadelphia, Pa. Filed April 30, 1901.

679,924. Electrical Controlling Means for Winding-Machines Richard Varley, Jr., Jersey City, N. J. Filed Sept. 20, 1900.

680,155. Lubricant for Commutators. William M. Jones, San Francisco, Cal. Filed Jan. 7, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

679,781. Telephone Exchange System. William M. Davis, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company. Filed Dec. 15, 1899.

679,788. Telephone-Exchange System. Daniel Sinclair and William Aitken, London, Eng., assignors to the Western Electric Company, Chicago, Ill. Filed Dec. 29, 1897.

679,805. Test System for Multiple Switchboards. Harry G. Webster, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, same place. Filed Oct. 29, 1900.

679,998. Counting Telephonic messages. Gustave Seligmann-Lui, Paris, France. Filed Sept. 25, 1900.

680,077. Telephone-Transmitter-Arm Joint. Herbert B. Sabin, Cleveland, O. Filed Jan. 28, 1901.

MISCELLANEOUS.

679,760. Electric-Elevator Controller. Nils O. Lindstrom, New York City, assignor to Alonzo B. See and Walter L. Tyler, same place. Filed April 15, 1901.

679,824. Art or Process of Refining Lead by Electrolysis. Anson G. Betts, Lansingburg, N. Y. Filed Oct. 12, 1900.

679,829. Cord-Adjuster for Electrical Conductor-Cords. David M. Carr, Rochester, N. Y. Filed April 6, 1901.

679,973. Electric Furnace. Denis Lance, Raphael L. E. de Bourgade and Leon Schmitz, Paris, France. Filed March 28, 1899.

679,997. Electrolytic Process of Obtaining Metals from Their Fused Compounds. George P. Scholl, Philadelphia, Pa., assignor to Charles W. Roepper, same place. Filed Nov. 14, 1898.

680,001. Wireless Telegraphy. Harry Shoemaker Philadelphia, Pa., assignor to Marie V. Gehring, same place. Filed Feb. 1, 1901.

680,002. Wireless-Telegraph System. Harry Shoemaker, Philadelpha, Pa., assignor of one-half to Gustave P. Gehring, same place. Filed April 18, 1901.

680,024. Telegraph-Relay. Julio E. Cordovez, Panama, United States of Colombia, Filed Aug. 14, 1900.

680,036. Electrical Signaling System. Julien A. Gehring, St. Louis, Mo. Filed March 14, 1901.

680,059. Electrical Call or Alarm Device. Alexander B. Miller, Newark, N. J. Filed Feb. 25, 1901.

680,060. Platform-Motor for Phonographs, etc. Walter H. Miller, Orange, N. J. Filed April 26, 1898.

680,120, Electric Fan. Edgar W. Brown, Dayton, O. Filed Nov. 8, 1900.

680,134. Electrical Contact Apparatus. Koloman de Kando, Budapest, Austria-Hungary. Filed Dec. 31, 1900.

680,150. Electric Cable. Carl A. W. Hultman, Stockholm, Sweden. Filed March 23, 1901.

680,151. Underground Conduit for Electric Conductors. Carl A. W. Hultman, Stockholm, Sweden. Filed March 23, 1901.

680,191. Electrolyzing Salts of Alkali Metals. Edward A. Allen, Rumford Falls, Me., and Hugh K. Moore, Lynn, Mass., assignors, by mesne assignments, to the Moore Electrolytic Company, Portland, Me., and Boston, Mass. Filed Oct. 22, 1897.

THE TELEPHONE WORLD.

Indiana Mutual Telephone Association Convention.

The annual convention of the Indiana Mutual Telephone Association was lately held in Lafayette. Mayor Justice made an address of welcome on behalf of the city, which was responded to by Charles A. Zion, of Lebanon, vice-president of the Association. Judge L. C. Walker, of Indianapolis, read a paper on "The Late Bell Monopoly—it Lived Unloved and Died Unmourned."

Among other papers read was one by George W. Beers, of Ft. Wayne, on "Independent Toll Lines"; also one entitled, "Our Friends the Enemy," by Geo. P. Haywood, city attorney of Lafayette. He was followed by C. A. Reaves, of Plymouth, who spoke on "Co-operation of Independent Telephone Companies."

On motion of S. P. Sheerin, of Indianapolis, 2,000 copies of the proceedings were ordered printed for general distribution. He said that he believed the organization should advertise its importance, as it was becoming a dreary factor in telephone circles. The election of officers resulted: President, L. A. Frazee, Connersville; vice-president, C. A. Zion, Lebanon (re-elected); secretary-treasurer, H. B. Gates, Indianapolis (re-elected).

The annual convention of the Southern Indiana Independent Telephone Association, which closed at New Albany lately, was largely attended and proved an enjoyable and profitable meeting to those present. Short talks were given by Mr. Coleman, of Louisville; Judge George B. Cardwell, James W. Dunbar, of New Albany; E. W. Pickhardt, of Huntingburg; J. E. Zeluff, of Toledo, O.; S. A. Dinsmore and J. J. Knarl, of Chicago and a number of others. At the closing session of the association Philip Dilley, treasurer of the Dubois County Telephone Company at Huntingburg, read a paper on "Free Service; Ought There Not to Be a Limit?" Other papers were read by J. W. Ladd, of Dale, Ind., on "Is It Profitable to Furnish Telephone Service at 50 Cents Per Month?" L. G. Davis, of Salem, on "Farmers' Lines; How to Make Them Profitable to the Local Exchange," and Charles F. Stevens, of Princeton, on "Benefits of Metallic Lines Over the Grounded System." The officers of the association were re-elected: They are: C. A. Kienle, Huntingburg, president; Charles D. Knoefel, New Albany, vice president; E. W. Pickhardt, Huntingburg, secretary; T. M. Thom, Lamar, treasurer.

The final defeat of the Bell telephone monopoly in Fredonia, N. Y., came recently when Manager Maytum of the Fredonia system of the Independent companies received notice from Director George H. Frost of Buffalo that President S. Fred. Nixon and the board of directors had authorized the reconstruction of the entire Fredonia system with full metallic circuits to join the general toll line independent system. This will extend by way of Dunkirk, which system will shortly be completed to Silver Creek, thence to Buffalo.

Kissimmee, Fla., is about to take another stride in progress, and by January 1 expects to have a first-class up-to date telephone plant. Senator C. A. Carson has obtained a charter through the city council, and will establish a local telephone exchange to be connected with a long distance telephone, reaching to Jacksonville and Tampa, touching at intermediate points.

The United States Electrical Supply Company has been organized at Butler, Pa., to manufacture telephones and telephone plants under patents of Dr. John W. Byers. John W. Brown is president; M. A. Berkheimer, vice-president; W. H. Miller, secretary; Chas. Bailey, treasurer, and Frederick E. S. Freers, general superintendent.

W. J. Bell, manager of the Baraboo, Wis., Telephone Company, has been granted a franchise by the village board of Kilbourn, in that State, to construct and operate a telephone exchange there. It is his intention to organize a company composed of the business men of Kilbourn and construct the lines at an early date.

The Home Telephone Company of Schenectady, N. Y., composed of business men in that city, is about to put a local independent telephone system into operation. The rate for a single house will be $1 per month, for an office $2 per month, and for both house and office for the same person $2.75 per month.

Announcement is made in Charlottesville, Va., of the combination of the Albemarle Telephone Company and the Inter-State Telephone & Telegraph Company. Both companies are to be operated in future by the Albemarle Telephone Company, with J. Frank Kelley, its superintendent, at the head of the dual corporation.

The London Telephone System to be Under Post Office Control.

A new telephone scheme is to be worked in London under the control of the Post Office, which will compete keenly against the monopoly of the National Telephone Company that has long usurped authority throughout the United Kingdom.

Using the language of the New York "Commercial," the installation into an office will be done for the nominal fee of £2, or $10, and that for every message transmitted there will be a subsequent charge of some say 2d. others 3d. while some contend it will be more.

John Gavey, one of the officials, said that October next would probably see the new system in full working order. The tariff scale has been under careful consideration, and will shortly be made public. Meanwhile, Mr. Gavey could not divulge particulars on that point, but he said the charges would be found reasonable. The charges will be made on what is called the toll rate system, which means a moderate annual subscription for installation and a payment for use regulated by the number of messages. This is deemed the most equitable method, inasmuch as payment is proportioned to use, and it may tend to greater appreciation of the telephone by persons who have not been able to avail themselves of its advantages.

Now that the operation of the Post Office system is not far off canvassing for subscribers will soon be brisk in the city.

Mr. Gavey claims that the vexatious imperfections of the telephone hitherto as a means of communication will not mar the service which is to be provided by the Post Office. Starting somewhat late in the day to provide a service for London, the Department has been able to profit by the best achievements so far of America and Europe. The Post Office itself has made a notable contribution to telephonic science, for, as Mr. Gavey pointed out in a paper he read at the Society of Arts:

"In the Post Office a system was designed under the instruction of Sir W. Preece, by which the removal of the telephone from its suspending hook actuated the indicator at the exchange. This method has now been adopted, and, with certain modifications, it promises to become the standard type of working in the United States."

The area of Greater London, which has to be dealt with presently by the Post Office telephone service, covers 640 square miles. It extends from Chipping Barnet and Enfield in the north to Bromley, Croydon and Redhill in the south, and from Romford, Erith and Crayford in the east to Harrow, Hanwell and Hounslow in the west, and it has an estimated population of 6,000,000 inhabitants.

The central exchange will be established at the Post Office Savings Bank in the city, and no fewer than 210 ducts will concentrate at that point. The districts beyond the economical range of the central exchange have to be served by branch exchanges, to be established in separate localities, each providing for the wants of a circle, with a radius ranging from one and a half to two miles.

The mechanical difficulties encountered in connection with the laying of the underground cables have been very great to a metropolis like London, which is honeycombed with conduits, pipes and sewers. There have been difficulties also in respect of an adequate supply of skilled labor and the getting of materials. In spite of all trials and obstacles, however, the work has gone on satisfactorily. The adoption of the dry core paper cable may be noted, for it is this discovery which has made telephony practicable on a large scale. It obviates the use of overhead wires on the one hand, and of gutta percha—which is growing scarcer and dearer for insulated underground wires—on the other.

"The result of these changes will be appreciated," says Mr. Gavey, "when it is considered that the 210 ducts concentrated at the Savings Bank Exchange will in round figures accommodate 85,000 wires, whereas, with the old method of working, they would only accommodate 16,500.

The New York Telephone Company, in view of the rapid increase in its Yonkers system, is about to erect a special telephone building for its exchange there. The company will fit up the new building with a complete new exchange equipment, having an ultimate capacity of about 6,000 subscribers' stations. The use of the telephone in Yonkers is enjoying a very rapid growth. The present number of stations in service is just over 1,600, and additional subscribers are being gained in large numbers.

The Washington, D. C. "Star" remarks that at the request of the Citizens' Northwest Suburban Association, the District Commissioners have decided to establish direct telephone connection at the new telephone exchange being established in Tenleytown between the police and fire departments of that suburb. The police connection will not be made until the new station house is built.

Memphis Telephone War.

There is war in the courts between the Independent and Bell Telephone Companies in Memphis, Tenn. The Cumberland Telephone & Telegraph Company has filed a bill against the Memphis Telephone Company in the Federal Court. The Cumberland Telephone Company asks for an injunction which shall restrain the Memphis Company from running its conduits through or against the manholes of the complainant. The Cumberland Company some time ago signed a bill with the city of Memphis whereby it should have exclusive use of the manholes, and the complainant therefore asks that the Memphis Company be compelled to construct its conduits around the manholes at a distance which will make it impossible to injure them.

The feeling between the two companies is very bitter, especially that of the Bell toward the Independent Company. It is thought this is simply the first move in the fight against the Independent line.

The Mansfield, O., Telephone Company, which is rapidly getting its line into readiness to serve local patrons in conjunction with its extended connections with outside lines, has added to its equipment by the purchase of the lines of the Farmers' Co-operative Telephone Company. There are about 175 subscribers of that line at Bellville and surrounding country and a good exchange at Bellville. There are about 75 or 80 miles of line in the purchase, and it will be operated by the Mansfield Company in connection with its other lines. Substantial reductions in telephone rentals have been made by the Central Union Company, and when the new company is fully prepared for business it is expected that additional reductions will be made.

A movement is on foot to organize a company and put in a new telephone system at Gallatin, Tenn. A petition is being circulated through Sumner County, and it is claimed by the promoters that it is meeting with good success. This town has a good telephone system, second to none, but some rulings just promulgated to the effect that no one shall use the 'phone except subscribers without paying for the same have created trouble between the company and some of the patrons. It is also claimed that some of the out-of-town patrons while in town wanted to use the 'phone and were refused the privilege unless they paid for the message, hence the trouble, the outcome of which cannot be foretold.

Attorney W. B. Quinlan has filed with the city clerks of Marinette and Menominee, Wis., applications for a franchise to build and operate telephone systems in both cities. The applicants for the franchise are former Gov. Edward Scofield of Oconto, and A. L. Hutchinson of Weyauwega. In their application the petitioners state there are 150 independent telephone companies in Wisconsin in operation, that they are being connected, and that an efficient system of toll lines is the result, and they secure cheaper 'phones and better service if they are given a franchise. They agree to have the new system in operation within a year.

The Southern Bell Telephone Company of Atlanta, Ga., returned its tax values to the State at $327,000. The Comptroller General has refused to accept, insisting upon an increase to $500,000.

The Independent Telephone Company of Temple, Tex., is at work with a large force of men putting up poles all over the town. It calculates to have its exchange ready for business by September 15.

The Hopkington Telephone Campany, Hopkington, Ia., has increased its capital stock from $3,000 to $10,000.

TELEPHONE INCORPORATIONS.

The Red River Telephone Company, Lawton, Okla. Capital stock, $50,000. Incorporators: Jacob C. Roberts, W. J. Steel and J. Y. Callahan of Kingfisher.

The Topeka & Elreno Telephone Company, Topeka, Kan. Capital stock, $10,000. Directors: W. F. Evans, Topeka; H. B. Low, Fort Worth; F. H. Wright, G. W. Bellamy and O. O. Blake, of Elreno.

The Bridgewater Telephone Company, Bridgewater, S. D. Capital stock, $2,300. Incorporators: T. W. Dwight, C. S. Meredith, Jacob Tschetter, W. W. Moyes and W. C. Burroughs.

The Southern Independent Telephone & Telegraph Company, El Paso, Tex.—to construct, maintain and operate a telephone and telegraph system in the city and county of El Paso. Capital stock, $200,000. Incorporators: Anney McElroy, Brett Lorain, Miller, and J. B. Badger, of El Paso; W. V. Smith and B. S. Sprague, of Cuyahoga County, O.

GENERAL ELECTRICAL NEWS.

Lighting.

Akron, O.—M. Spitzer is preparing plans for an electric light and power plant for the Canton-Akron Electric Railway Company in this city to cost $50,000.

Cameron, Tex.—Judge Henderson, M. M. Kemp and others of the Cameron Waterworks Company have purchased the water system at Rosebud, and will put in a good electric light system there.

Charlestown, W. Va.—C. H. Emig, of Hanover, Pa., and associates have purchased a water power near this city with a view to developing it to operate their established electric light plant.

Dalton, Pa.—The charter for an electric light company has been applied for by a company, at the head of which is Mr. Allen, secretary of the International Correspondence Schools Company. The new concern will secure franchises from the boroughs of Dalton, Clark's Summit, Clark's Green, Waverly, Glenburn and Factoryville. It is intended by the concern to provide all of the towns north of the mountain with electric light accommodations. The plant to generate the power will be located here and the lights will be incandescent.

Des Moines, Ia.—Articles have been filed by the Manning Electric Light Company with a capital stock of $50,000. Peter Ohrt, president and manager, W. B. Swaney, secretary and treasurer and Honnes Ohrt, superintendent.

Dolgeville, N. Y.—The Dolgeville Electric Light & Power plant will be sold under foreclosure in September.

Evansville, Wis.—A special election will be held in this city for the purpose of voting on the matter of a system of waterworks and electric lighting.

Indianapolis, Ind.—Bids on the new public electric lighting contract will be opened August 31 by the board of public works. The contract will then be awarded unless new trouble arises from further injunction proceedings.

La Crosse, Wis.—The Neshonec Electric Light Company, with a capital stock of $100,000, has been formed in this city to buy the electric light plant and water power at West Salem, to extend the wires from the power house at West Salem to Bangor, a distance of 12 miles, and to furnish that city with an electric lighting system.

Little Rock, Ark.—This city is considering an expenditure of $25,000 to enlarge and improve its lighting system.

Montesano, Wash.—Engineer M. B. Koontz has a crew of men at work at Silvia Lake making preparations to install an electric light plant.

Peoria, Ill.—H. F. Townsend, county treasurer, has purchased the electric light plant at Lewistown.

Stafford, Kan.—The citizens are preparing to vote on a proposition to install a waterworks and electric light plant.

Street Railways.

Attleboro, Mass.—It is said here that prominent financiers of Boston and vicinity have engaged in an enterprise to establish an electric road from Providence to Boston. The line will run through Hyde Park, Mansfield, Canton, Sharon and East Foxboro. The story is that the highways will not be used, the idea being to run electric express trains from town to town.

Auburn, Ind.—The city council has granted the Garrett, Auburn & Northern Electric Railway a franchise, which was accepted by the company, and now the electric railway has a franchise from the city limits at Garrett to Hamilton.

Baraboo, Wis.—G. I. Hicks, president of the Sauk County Traction & Power Company, was lately in this city looking over the ground for the new electric railway between Kilbourn and Devil's Lake.

Battle Creek, Mich.—The Gordon Traction Company is figuring to build an electric line between here and Lansing.

Cleveland, O.—The Lake Shore Electric Railway Company of this city has been incorporated, to construct and operate an electric line from here to Toledo through Cuyahoga, Lorain, Huron, Erie, Sandusky, Ottawa, Wood and Lucas Counties. The incorporators are B. Mahler, F. W. Coen, D. G. Jaeger, A. M. Snyder, E. M. Gronmeyer and L. M. Hildreth.

Columbus, O.—An electric railway project to parallel the Hocking Valley Railroad from Fostoria to this city is now being agitated. The route proposed will touch the towns of Carey, Upper Sandusky, Marion, Prospect and Delaware, and will be an air line.

Edgefield, S. C.—A meeting of the citizens will be held for the purpose of considering the building of an electric line between here and Augusta, Ga., a distance of about 23 miles.

Galion, O.—Another electric road will probably traverse Crawford County; the Buckeye Traction Company was granted a franchise by the county commissioners giving it the right to construct an electric railway from Bucyrus to Sulphur Springs.

Golden's Bridge, N. Y.—The State Railroad Commission, in session in New York City August 7, practically decided to grant a certificate for the construction of an electric road from this place in Westchester County, to the Connecticut State line near Danbury, and thence to Peach Lake.

Hellertown, Pa.—A trolley road will be built from here to Riegelsville.

Jackson, Miss.—There is talk of an electric railway from this city to Mississippi Springs, some 12 miles distance.

Mt. Joy, Pa.—The borough council has passed an ordinance granting the Lancaster & Mt. Joy Electric Railway the privilege of using the borough streets.

New Berlinville, Pa.—The trolley company here has decided to erect a power house near the Oley line.

New York City.—A syndicate has acquired the five street railway properties in and around Utica, and they will be connected, re-equipped and extended. The completed system will be of the highest efficiency in equipment and construction. The properties, with the expenditures involved, will represent a cost of more than $3,000,000, a portion of which will be provided by an issue of bonds, which has been placed with N. W. Harris & Co., bankers of this city.

Norristown, Pa.—The construction of a trolley line from Hatboro to Ambler, and then direct to this place is being agitated.

Sheboygan Falls, Wis.—The Sheboygan and Elkhart Lake Railway & Electric Company was lately organized with John M. Seamann, of Sheboygan, as president. The capital stock is $200,000.

Springfield, O.—The Pennsylvania Railroad officials have determined to meet the competition of the interurban lines by equipping a branch between this city and Xenia with electricity, and in case the experiment proves a success it is said that the road will equip all its branch lines in a similar manner.

White Plains, N. Y.—The New York & Stamford Railway Company was formed at White Plains recently, with a capital of $500,000, to build a through trolley line to Boston. The company represents the consolidation of the Larchmont and Port Chester electric companies which now operate trolley systems from Larchmont to Port Chester. The new company is now building a road to Greenwich, and as soon as this line is completed the road will be extended to Stamford and afterward to Boston.

Manufacturing.

Dover, Del.—The Delaware Corporation Company recently sent to this city articles of incorporation for the Aladdin Manufacturing Company, capitalized at $50,000, in which New York parties are interested. It is to to make lamps and electrical and other lighting devices.

Hartford, Conn.—The Acme Switch Company has filed articles of incorporation with the city clerk. The concern will manufacture tools for electrical work and has a capital of $12,500.

Oswego, N. Y.—The Ames Iron Works Company has nearly completed and ready for shipment to San Juan, Porto Rico, one of its largest sized high-speed engines 400 horse power. It is to be used for generating electricity there for the street railway.

Pittsburg, Pa.—Application will be made at Harrisburg on August 26, by Samuel F. Hammond, Henry M. Laughlin and Robert R. Hammond, for the incorporation of four companies to do business in this city. The first concern will be called the Laughlin Manufacturing Company, which will manufacture electrical machinery, supplies and apparatus; the second will be known as the Hammond Supply Company, which will deal at retail in all kinds of electrical machinery, supplies and apparatus; the third will be known as the Laughlin Supply Company, which will deal at wholesale in all kinds of electrical machinery, supplies and apparatus; the fourth will be given the name of the Hammond Manufacturing Company, the object of which is to manufacture articles of iron and steel.

Company Matters.

Buffalo, N. Y.—At a recent meeting of the Elmwood Avenue & Tonawanda Electric Railway Company the following directors were elected: W. Caryl Ely, William B. Rankine, Bert Van Horn, Francis Lynde Stetson, T. Dewitt Cuyler, Robert Bacon, Daniel S. Lamont, E. G. S. Miller and Joseph B. Mayer.

Detroit, Mich.—It is practically settled that the Olds Motor Works will leave this city and return to Lansing.

Power and Transmission.

Griffin, Ga.—Hon. Seaton Grantland, who owns High Falls, an immense water power, which is now 18 miles "around the road" from here, is perfecting arrangements to develop it for the purpose of furnishing electric power to this city and probably to Forsythe, Jackson, Barnesville and other smaller villages. It is one of the finest falls in the State and the power will be sufficient to give almost unlimited horse power

Labarge, Mich.—The new plant of the Thornapple Electric Company at this place is well under way, and a large force of men is employed putting up the buildings and constructing the big dam. The company will furnish electricity for lighting the streets of Hastings, Middleville and Nashville, and will supply electric power to manufacturing firms in each of the three cities. The water power here will be sufficient also to run a mill to be erected by the company at this point.

Los Angeles, Cal.—The California Power Company, composed of Redlands, Pasadena and Los Angeles capitalists, has begun active work upon its enterprise of developing electric power from the Kern River with a view of transmitting it to the cities of the southern part of the State.

Minneapolis, Minn.—It is announced that the Twin City Rapid Transit Company, which obtained authority from Congress at the last session to dam the Mississippi River at Koon's Rapids above here and develop power, has begun work on the actual construction of the dam, the preliminary work of taking soundings having been completed. It is estimated that the cost of the new dam will be $600,000, and that a minimum of 10,000 horse power can be developed at the rapids.

Salt Lake City, Utah.—The ordinance granting the Telluride Power Company the right to erect electric transmission lines on certain streets was recently amended.

Automobiles.

Oneida, N. Y.—The Oneida Automobile Company has been formed with a capital of $5,000. Theodore Coles, H. M. Reynolds and S. Allen Clark, all of Oneida, are the directors.

Rockford, Ill.—The Rockford Automobile Company, capitalized at $100,000, for the purpose of manufacturing and dealing in automobiles, has been incorporated by A. Zeller, R. K. Swift and M. R. Drick.

Springfield, O.—Kuqua & Son, carriage builders, propose to add the manufacture of automobiles to their establishment.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.–Aug 12						
United Traction	100	$5,000,000	$5,000,000	1½ % Q.,	104	105
(Consolidation of the Albany and Troy City Railway.)						
Allentown Pa.–Aug 12						
Allentown & Lehigh Val. Trac. Co	...	4,000,000	1,500,000	....	--	15
Bridgeport, Conn–Aug 12:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug.,	100	...
Baltimore Md–Aug 12						
a United Rail ways & Elec. Co...com	50	24,000,000	13,000,000	....	16	16⅛
Boston, Mass.–Aug 12						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15,	...	..
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	15	16
North Shore Traction Co.......pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	85	87
b West End Street Ry. Co......com.	50	10,000,000	[illegible]	3½ % S., Oct.,	95	95¼
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Jan.	110	110⅛
Boston Elevated R. R	100	10,000,000		2¼ % Aug. 99,	186	187
Brooklyn N. Y.–Aug 12:						
Brooklyn City Ry	100	2,000,000	1,928,400	....	242	244
Brooklyn Rap. Transit Co., tr certf..	100	48,000,000	48,000,000	....	73⅝	73¾
*c*Brooklyn Heights Railroad	....	200,000	200,000	....	107	109
* *d*Brooklyn City RR.........guar	100	12,000,000	12,000,000	3½ % Q., Jan.,	287	289
*e*Brooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	2,000,000	1,884,200	2½ % Nov.,	325	330
Kings County Elevated	....	4,750,000	4,750,000	....	--	...
Kings County Traction Co	100	4,500,000	4,500,000	1 % July	..	..
Nassau Electric Railroad ....pfd.	......	6,000,000	6,000,000	....	82	85
*f*Atlantic Avenue Railroad	50	2,000,000	2,000,000	....	--	--
*g*Brooklyn, B. & W. E. Railroad..	....	1,000,000	1,000,000	....	--	--
Buffalo N. Y.–Aug 12						
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	....	74	75
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec.	99	100
Columbus O.–Aug 12						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb.	45	47
Columbus Street Railroad, pfd....	100	1,500,000	1,500,000	....	102	105
Charleston, S. C.–Aug 12						
Charleston City Ry. Co	50	100,000	100,000	8 % S.	--	--
Enterprise City RR. Co	25	1,000,000	250,000	....	--	--
Chicago, Ill.–Aug 12						
Chicago City Ry. Co	100	12,000,000	12,000,000	8 % Q., Dec. 31,	.00	203
Chicago & South Side R. T. RR	100	10,828,800	10,828,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12¼	13
Metropolitan West Side Elev. Ry...	100	15,000,000	7,000,000	Feb 28 1900.	36	36½
Met. West Side El., pfd	100	15,000,000	9,000,000	....	9½	36
North Chicago Street RR	100	10,000,000	6,600,000	8 % Q., Jan.	209	210
*h*North Chicago City RR	190	500,000	249,900	....	200	202
South Chicago City Railway	100	2,000,000	1,608,200	....	108	109
West Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Feb.	100	100½
Union Traction Ry.............com	....	1,250,000	624,900	35 %	15	16
Union Traction Co.............pref	100	2,000,000	2,000,000	5 % S.	58	59
Cincinnati, Ohio.–Aug 12						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	--	--
Cincinnati Inc. Plane Ry.......pfd.	50	150,000	150,000	½ % Feb.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	3,000,000	3,500,000	2½ % Feb.	75	76
*i*Cincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan.	124½	125
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan.	126½	127
Cleveland, Ohio–Aug 12						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan.	48	50
Cleveland City Ry	100	8,000,000	7,600,000	3-5 % Jan.	.02	1(3
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct.,	83½	85⅛
Detroit, Mich.–Aug 12						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	00½	--
Ft. Wayne & Belle Isle Ry	100	....	1,200,000	....	75	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	75
Wyandotte & Detroit River Ry	100	250,000	200,000	....	00	[illegible]
Dayton O.–Aug 12						
City Railway Co............com.	100	1,500,000	1,470,600	1¼ % Q.	.40	145
City Railway Co............pfd.	100	600,000	600,000	1½ % Q.	70	..
People's Street Railway	..	1,100,000	1,100,000	....	14	115

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn–Aug 12						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Oct.,	150	–
Hartford & West Hartford	100	1,000,000	247,000	....	--	–
Holyoke Mass.–Aug 12						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., June,	207½	212
Hoboken N. J.–Aug 12						
North Hudson Co. (N. J.) Ry. Co..	25	1,250,000	1,000,000	8 %,	150	–
Indianapolis, Ind–Aug 12						
**Indianapolis Street Ry	....	5,000,000	5,000,000	....	25	25½
Lancaster, Pa.–Aug 12						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	--	..
Lancaster & Col. Electric Ry	....	....	87,500	....	--	...
West End Street Railway	...	....	....	....	--	..
Louisville, Ky.–Aug 12:						
Louisville Ry..............com.	100	4,000,000	3,500,000	1¼ %., April.	82	83
Louisville Ry..............pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1,	112	113
Minneapolis, Minn.–Aug 2						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	89	89¼
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,712,200	1¾ %. Oct.	186	187
Montreal, Canada.–Aug 12						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	290	291
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J. †	109¾	109⅞
Memphis Tenn.–Aug 12						
Memphis Street Railway Co	100	500,000	500,000	....	25	–
New Haven, Conn.–Aug 12:						
Fair Haven & Westville RR	25	2,000,000	2,000,000	8 % S., Sept.	39	41
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July	...	...
New Haven & Centerville	100	700,000	300,000	....	..	–
Winchester Avenue RR	25	1,000,000	600,000	....	45	46
New Orleans, La.–Aug 12						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., July,	..	--
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Oct.	148½	153
New Orleans Traction Co new com.	100	....	....	....	26	28
New Orleans Traction Co new pfd.	100	....	....	....	102	103
*a*Crescent City RR..........guar.	100	2,000,000	2,000,000	8 % S., Jan.,	20½	[illegible]
*b*New Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan.,	--	--
Orleans Railroad	50	500,000	185,000	1½ %., June,	..	52
St. Charles Street Railway	50	1,000,000	1,000,000	1¼ %. Oct.,	56½	57
New York–Aug 12:						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	260
*c*Christopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Oct.,	.75	185
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Nov.	120	185
*d*Metropolitan Street Ry. Co	100	45,000,000	45,000,000	2½ % Q., Feb., 1901.	166	166¼
*e*Bleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July,	34	36
*f*Broadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	244	249
*g*Cen. Park, N. & E. Rivers RR. guar	100	1,800,000	1 [illegible]0,000	2¼ % Q.	205	210
*h*Eighth Avenue RR	100	1,000,000	1,[illegible]0,000	....	400	410
*i*42d St. & Grand St. Ferry RR. guar	100	750,000	[illegible]8,000	4½ % Q.	390	400
*j*Ninth Avenue RR..........guar.	100	800,000	800,000	....	198	205
*k*Sixth Avenue RR..........guar	100	2,000,000	2,000,000	....	200	205
*l*Twenty-third St. R. R. Co..guar.	100	600,000	6 ,000	4½ % Q.	400	410
Second Avenue RR	100	2,500,000	1,8 ,000	2 % Q., Jan.,	212	215
Third Avenue RR	100	12,000,000	10,0 000	$1.75 p. sh. Feb.	121	121
*m*42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,50 000	....	65	75¼
*Union (Huckleberry) Ry	100	2,000,000	2,00 000	....	190	200
Newark N. J.–Aug 12						
Consolidated Traction Co of N. J...	100	15,000,000	[illegible],000,000	....	66	68
North Jersey Railway Co	100	6,000,000	[illegible]000,000	....	24	25
United Elec. Co. of New Jersey..	100	504,000	504,000	11¼ % A.	280½	282
Pittsburg, Pa.–Aug 12						
Allegheny Traction Co	50	500,000		....	27	28
*o*Consolidated Traction Co....com.	50	15,000,000		2 %, Jan.	20	21
Consolidated Traction Co......pfd.	50	9,478,850		3 %, Nov.	58	59
*p*Central Traction Co	50	1,500,000		1½ % Nov.	78½	78¼
*q*Citizens' Traction Co	50	3,000,000		6 % A.	72½	72⅞
*r*Duquesne Traction Co	50	3,000,000		6 % A.	..	...
*s*Pittsburg Traction Co	50	2,500,000		8½ %, Nov.	..½	..
Federal St. & Pleasant Valley Ry..	25	1,400,000		2½ %, July,	27	29
Pgh., Allegheny & Man. Trac. Co....	50	3,000,000		2 %, Aug.	..	..
Pittsburg & Birmingham Trac. Ry..	25	1,500,000		1 %, Oct.	41	42½
Pittsburg & West End Ry	50	3,000,000		5 % A., June	..	..
United Traction Co..............com.	50	17,000,000		J. & J.	18¼	18½
United Traction Co..............pre	50	3,000,000		J. & J.		

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*Unlisted. ‡ Ex div.

a The United Railways & Electric Company comprises in its organization the Baltimore Consolidated Railway Company, the Baltimore City Passenger Railway Company, all the lines of street railway operated by these companies, and also the Central Railway Co of Baltimore. The pref stock of U R & Elec Co has been issued in the form of income bonds.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee–West Chicago St. RR. Co.; $250 100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee–North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranted by West Chicago Street Railway Company, lessee.

l Cincinnati St. Railway purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. | Outstanding. ‡ Ex-div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry–now Metropolitan Street Railway.

g Leased to Metropolitan Street Ry. at 8 % on stock until Oct. 1, 1897; thereafter 9 %.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1895, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter.

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 % on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens' Duquesne, Fort Pitt & Pitt'h Traction.

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock.

s Leased to Consolidated Traction Company for 7 % on capital stock.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.—Aug 12						
Union Street Railway Co	100	$350,000	$350,000	2 %, Feb.	160	165
Northampton, Mass—Aug 12						
Northampton Street Ry	100	300,000	225,000	4 % A., June.	170	178
Omaha, Neb.—Aug						
Omaha Street Ry	100	5,000,000	5,000,000	3 % A. and N.	55	65
Paterson N. J.—Aug 12						
Paterson Ry. Co.	100	1,250,000	1,250,000	....	54	--
Providence, R. I.—Aug 12						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Oct.	109	110
Philadelphia.—Aug 12						
Fairmount Park Trans. Co...$50 pd.	50	2,000,000	1,770,000	2 %, Dec.	23	24
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15,	47	48
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	583,900	‡583,900	3 % S—July,	75	76
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1,	26½	27
Union Traction Co.........$17½ pd	50	30,000 000	29,980,450	....	26¾	27
cElectric Traction Co.	50	....	8,297,920	....	..	...
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	345	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.	450	451
fLehigh Avenue Ry. Co	50	1,000,000	....	....	48	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	90	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar.	300	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April,	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—	150	151
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan.,	151	152
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	....	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh. Oct.	95¾	96
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar.,	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July	158	157
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July	208	208¼
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$8.50 share July	100	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July	308½	309
jPhiladelphia & Darby Ry. guar.	50	....	‖200,000	$2 share July,	...	..
j17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July,	..	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖385,000	$11 sh. A., July,	300	..
jUnion Passenger Ry. Co.	50	1,500,000	‖900,000	$9.50 shre, July	239	240
jWest Philadelphia Pass. Ry.	50	750,000	‖750,000	$10 share, July	262	263
Rochester, N. Y.—Aug 12						
Rochester Railway Co.	100	5,000,000	5,000,000	....	25	28
Reading, Pa.—Aug 12						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	24	26
kCity Passenger Ry	50	350,000	350,000	Jan.,	138	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan.,	70	--
St. Louis Mo.—Aug 12						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	--	--
Jefferson Avenue Ry. Co.	50	400,000	400,000	2 % Dec.	--	--
Lindell Ry.	100	2,500,000	2,400,000	1¼ % Jan.	--	--
National Railway Co.	..	2,500,000	2,479,000	1½ % Jan.	--	--
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	--	--
Citizens' RR.	100	2,000,000	1,500,000	4 %, Oct.,	--	--
St. Louis RR.	100	2,000,000	2,000,000	2½ %, Jan.,	...	--
Missouri RR.	50	2,400,000	2,800,000	1½ % Jan.,	--	--
People's RR. Co	50	1,000,000	800,000	50c., Dec.,	..	...
United Electric Ry.........com.	50	500,000	500,000	....	27	27½
United Electric Ry....... 5 % pref.	100	1,000,000	1,000,000	3 %, Jan.,	79½	81
St. Louis & Suburban Ry	100	3,000,000	2,500,000	....	90	95
Union Depot RR.	100	4,000,000	4,000,000	3 % A., July,	--	--
San Francisco, Cal.—July						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	117	119
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share,	50	..
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	61½	63⅛
Presidio & Ferries RR	100	1,000,000	550,000	....	--	16
Scranton Pa—Aug 12						
Scranton Railway Co	50	6,000,000	2,500,000	....	29	30
m Scranton & Carbondale Trac. Co.	100	500,000	500,000	....	16½	...
m Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	--	--
Springfield Ill.—Aug 12						
Springfield Consolidated Ry	100	750,000	750,000	....	---	--
Springfield O.—Aug 12						
Springfield Street Ry	100	1,000,000	1,000,000	....	--	11
Springfield, Mass.—Aug 12						
Springfield Street Ry	100	1,200,000	1,166,700	% A.	207	212
Toronto Canada.—Aug 12						
Toronto Street Ry	100	6,000,000	6,000,000	1¾ % S.	109¼	110⅛
Montreal Street Railway Co	.....	4,000,000	4,000,000	4 % S.	279	280
Washington, D. C.—Aug 12						
Belt Ry. Co	50	500,000	500,000	....	--	--
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct.	103¾	103⅞
Columbia Ry. Co	50	400,000	400,000	6 % A.	--	...
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	35	40
Georgetown & Tenallytown Ry	50	200,000	200,000	....	20	21
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	--	--
Worcester, Mass.—Aug 12						
*Worcester Traction Co.......com.	100	3,000,000	3,000,000	....	32¼	35
Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb.,	107	108
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %,	...	85
Wilkesbarre, Pa.—Aug 12						
Wilkesbarr & Wyoming Val Trac.	100	5,000,000	5,000,000	1%, Jan.,	25	26

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* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex-div.

a Leased to Hestonville, Man & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

j Leased to United Traction Company at a rental of $10,000 per annum in 1866-7-8, p. a. $20,000 in 1899-1900 and $30 000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6 % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Co., formerly Scranton Traction Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 12						
American Te & Tel Co	100	50,000,000	28,650,000	4½ % Q., Jan.	159⅞	160
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Feb. 20,	48	48¼
New England Telephone Co	..	10,394,600	10,304,600	$1.50 p. sh. Feb	139	140
New York.—Aug 12						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	91	94
*Central & South Am. Teleg. Co.	100	6,500,000	6,500,000	1½ % Q.	105	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	178	175
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	42	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Feb.,	..	..
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	108	109
*International Ocean Tel Co. guar 6 %	100	3,000,000	......	1½ % Q.	116	118
Mexican Telephone Co	100	2,000,000	......		2	2½
*New York & New Jersey Tel. Co.	100	5,000,000	3,728,000	2½ % Q., Jan.,	168	178
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	70	75
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	
*Sout'n & Atlantic Telg. Co. guar. 5 %	25	950,000	559,525	2½ % S.	100	110
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan.,	119	124
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Q, Jan.	92½	94¼
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Aug 12:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q.	26	37
Bell Teleph. Co. (of Canada.)	100	3,960,000	3,564,000	2 % S.	188	..
Chesapeake & Potomac Telep. Co.	100	......	......	....	67	70
Chicago Telephone Co	100	......	......	......	200	210
Central Dist Prtg & Telg. Co. (Pgh.).	100	750,000	750,000	....	148	150
Empire & Bay States Telegraph Co.	..	......	......	....	75	76
Hudson River Telephone Co	109	2,000,000	2,000,000	1 % Q.	120	125
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	122	126
Providence (R. I.) Teleph. Co	50	......	......	....	96	97
Southern New Eng. Teleph. Co	100	8,000,000	......	....	...	--

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 12						
Fort Wayne Electric trust receipts	..	......	......	....	115	125
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	15	25
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	
General Electric Co. [new] ...... “	100	18,276,000	18,276,000	2 % Q., July, 1901	250	250¼
T.-H. Elec. Co..T. Secur., Series C.	..	......	......	....	22	28
Westinghouse Elec. & Mfg. Co. com.	50	......	146,700	....	70	70¼
Westinghouse El. & M'g. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q.,	77¼	78
Westinghouse El. & M'g. Co. rights.	50	11,000,000	8,195,126	......	1¼	1⅜
New York.—Aug 12						
Edison Elec. Ill'g Co., New York	100	9,188,000	7,988,000	....	119	120
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	2,000,000	1½ % Oct., '98.	--	..
Edison Ore Milling Co	100	......	......	....	8	12
Electric Vehicle Co..........com.	..	......	......	....	--	--
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	--	...
General Electric Co. [new].... “	100	18,276,000	18,276,000	2 % Q., July, 1901	250¼	250½
Interior Conduit & Insulation Co.	100	1,000,000	1,000,000	....	41	--
‖ Kings Co. El. L. & P. Co.	100	2,500,000	2,500,000	A. & O.	118	125
Pittsburg, Pa—Aug 12						
Allegheny County Light Co	100	500,000	500,000	J. & J.	168	172
East End Electric Light Co	50	300,000	300,000	Q	--	--
Philadelphia, Pa.—Aug 12						
Edison Electric Light Co	100	2,000,000	......	......	144	1[illegible]
*Electric Storage Battery Co..com.	100	8,500,000	......	......	70	75
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	70	75
Northern Elec. Light & Power Co.	10	550,000	550,000	......	18	[illegible]
Southern Elec. Light & Power Co.	10	187,500	187,500	....	30	--
Miscellanoeus.—Aug 12						
Bridgeport (Conn.) Elec. Lt. Co.	25	500,000	......	......	47	48
Missouri-Edison (St. Louis)....com.	..	......	......	....	20	21
Eddy Electric Mfg. Co	25	......	......	....	9	10
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	190	191
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	6	[illegible]
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	95	
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct.,	93	94
Rhode Island Elec. Protec. Co	100	......	......	....	118	120
Royal Elec. Co. (Montreal)	..	1,000,000	.....	1% Q ‡	250	251
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	136	138
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1,	..	130
Woonsocket (R. I.) Electric Co	100	......	......	....	105	106

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

‖ Recently acquired the Edison Illuminating Co. of Brooklyn and its constituent company, the Municipal Electric Light Co.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Aug 12						
American Electric Heating Co	50	10,000,000	....	....	--	--
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh.	--	--
United Electric Securities Co...pfd.	100	......	1,000,000	$3.50 p. sh.	-	100
New York.—Aug 12						
Consolidated Electric Storage Co.	...	......	....	....	8	12
Safety Car Heating & Lighting Co.	100	......	....	......	150	155
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	..	
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 % A	118	114
Philadelphia Pa.—Aug 12						
Electro Pneumatic Trans. Co	10	1,500,000	......	--	1⅛	1¼
United Gas Improvement Co..scrip.	50	10,000,000	......	--	..	162
Welsbach Commercial Co.....com.	100	8,500,000	......	--	20⅞	21⅛
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	73	75
Welsbach Light Co	5	525,100	......	....	54	55
Welsbach Light Co., Canada.	5	500,000	......	....	1	1⅛
Pittsburg, Pa.—Aug 12						
Carborundum Mfg. Co	100	200,000	200,000	....		
Standard Underground Cable Co.	100	1,000,000	1,000,000	Q	224	227
Miscellaneous.—Aug 12						
Barney & Smith Car Co.......com.	100	......	1,000,000	--	20	25
Barney & Smith Car Co........pfd.	100	......	500,000	2 %	120	129
Billings & Spencer Co	25	......	....	....	87	
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb	54	56½
Johns-Pratt Co	100	....	....	--	105	109
Pratt & Whitney Co.........com.	100	......	....	--		
Pratt & Whitney Co..........pfd	100	....	......	--	85	90
Stillwell-Bierce Co.........com.	..	....	.....	--		50
Stillwell-Bierce Co..........pfd.		....	....	2 % Sept	65	70
Shultz Belting Co		500,000	....	....	80	90
St. Charles Car Co		------	------	----	89	98

Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany N. Y.

Date of Quotation—Aug 12, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry. Co……Cons. mtg. 5s	$500,000	427,500	1940	J. & J.	117⅛	……
†The Albany Ry. Co……Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*116½	……
‡Watervliet Turnpike & RR. 1st mtg. 6s	350,000	350,000	1919	M. & N.	*125	....
‡Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*124	126
Troy City Railway Co……1st 5s	....	....	1942	……	*116½	118

†Interest guar. by Albany Ry. Co.

‡Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Aug 12, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
United Electric Ry. Co…1st mtg. g. 4s	38,000,000	18,000,000	1949	M. & S.	102	102¾
" " " ……income 4s.	14,000,000	…………	1949	J. & D.	74¾	75
Baltimore City Pass. Ry..1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	118⅞	….
†Baltimore Traction Co……1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	119	120
†Baltimore Trac. Co. Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	104⅛	……
†Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	121	121⅛
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	………	1900	J. & J.	101	……
†Baltimore Traction Co. Convertible 5s.	800,000	………	1906	N. & M.	102⅝	……
†Central Pass. Ry. Co……1st mtg. 6s.	96,000	117,000	1912	J. & J.	…..	….
†Central Pass. Ry. Co..Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	119	121
†City & Suburban Ry……1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	116	117
†Lake Roland Elev.,……1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	117	……

☞ All of the bonds of the above companies, marked †, have been assumed by the United Railways & Electric Company.

Boston Mass.

Date of Quotation—Aug 12, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR……1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	114	115
West End Street Ry……Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104⅛	106
West End Street Ry……Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	112	….

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Aug 12, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR……1st mtg. 5s.	500,000	47,000	1906	J. & J.	….	….
†Charleston City Ry……1st mtg. 6s.	350,000	….	….	J. & J.	106	….

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Aug 12, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry……1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¾	.2¾
‡Chicago Passenger Ry……1st mtg. 6s.	400,000	400,000	1903	F. & A.	….	102
‡Chicago Passenger Ry…Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	……	….
¶Chicago & So. Side R. T…1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	….	….
Chicago & So. Side R. T……4½s.	1,500,000	750,000	1907	J. & J.	….	……
‖Chicago West Div. Ry……1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	108⅛	109
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	….	……
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	96	96⅝
North Chicago St. RR……1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	106	……
North Chicago St. RR….Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	….	……
North Chicago City Ry……1st mtg. 6s.	500,000	500,000	1900	J. & J.	….	……
North Chicago City Ry……consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	108	……
West Chicago St. RR……1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	……	111
West Chicago St. RR……Deben. 6s…	2,700,000	700,000	1911	J. & D.	101	102
West Chicago St. RR….Con. mtg. g. 5s.	12,500,000	6,000,000	1936	……	106⅝	107
‖W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	….	….

†Redeemable at option on 60 ds. notice.

‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.

¶Subject to call after Oct. 1, 1899, at $110 and interest.

'Assumed by W. Chi. RR. Co.. lessee

‖Int. guar. by W. Chicago St. RR. Co

Cincinnati O.

Date of Quotation—Aug 12 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	114⅛	115
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103⅛	104
†Mt. Adams & Eden P'k In…1st mtg. 6s.	100,000	100,000	1905	A. & O.	114	……
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	581,000	581,000	1906	M. & S.	108¾	……
So. Cov. & Cin. St. Ry……1st mtg. 6s.	250,000	250,000	1912	M. & S.	121⅛	122⅛
‡So. Cov. & Cin. St. Ry……2d mtg. 6s.	400,000	400,000	1932	J. & J.	132¾	137

† Assumed by the Cincin. St. Ry. Co.

‡$250,000 reserved to retire 1st mtg. bds.

Cleveland O.

Date of Quotation—Aug 12, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co……1st mtg. 6s.	600,000	600,000	1908	M. & S.	106½	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	113½	114⅛
Cleveland City Cable Ry….1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	105½	106
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	106	107
Columbus (O.) Cent. Ry…1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	……	……
aEast Cleveland RR……1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	……	107½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	………	1922	M. & N.	……	….
Lorain (O.) Street Ry……1st mtg. 6s.	200,000	200,000	1915	J. & J.	……	….
‡St. Ry. Co., Grand Rapids…1st mtg. 5s.	600,000	600,000	1912	J. & D.	….	….

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.

‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Aug 12, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry……1st mtg. 5s.	7,000,000	3,885,000	1905	A. & O.	……	102½
Ft. Wayne & Belle Isle Ry…1st mtg. 6s.	400,000	377,000	1902	A. & O.	….	….
The Detroit Ry……1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	105	106½

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Aug 12 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St Ry……1st mtg. g. 5s…	600,000	600,000	1913		111	….
New Haven, Edgewood Div., 1st mtg. 5s.	250,000	250,000	1914	J & D	111	……
Winchester Avenue RR., 1st mtg. g. 5s..	100,000	500,000	1912	M& N	109	……
Winchester Avenue RR…… Deben 5s.	100,000	24,000	1913	M& S		….

New Orleans La.

Date of Quotation—Aug 12 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR… cons mtg. 6s.	$150,000	$150,000	1912	M. & N.	……	….
Crescent City RR……1st mtg. 6s.	…….	50,000	1899	M. & N.	105⅛	……
Crescent City RR……Cons. mtg. g. 5s.	5,000,000	3,000,000	1948	J. & J.	……	….
New Orleans City RR……1st mtg. 6s.	416,500	399,000	1903	J. & D.	106	112
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1948	J. & J.	112	113
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	……	……
Orleans Railroad Co……Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	……	……
‡St. Charles St. RR. Co……1st. mtg. 6s.	300,000	75,000	1906	J. & D.	……	……

†$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.

‡$90,000 outstanding.

New York.

Date of Quotation—Aug 12 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)….Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	……
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107⅛	110
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	115	116
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	123	125
Broadway & 7th Ave……1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	105⅛
Broadway & 7th Ave……2d mtg. 5s.	500,000	500,000	1914	J. & J.	108	110
Broadway Surface……1st mtg. 5s.	1,125,000	1,125,000	1924	……	115	117
Broadway Surface……2d mtg. 5s.	1,000,000	1,000,000	1905	……	105	106
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	115	116
¶Brooklyn, Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	101	….
Brooklyn Heights RR……1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	……
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	112	….
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	107	….
Brooklyn Rapid Transit……gold 5s.	7,000,000	5,181,000	1945	………	108⅛	……
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	……	98⅛	100⅛
Cent P'k, N. & E. R. RR. 1st cons. mtg. 4s.	1,200,000	1,200,000	1902	J. & D.	107	109
Central Crosstown RR……1st mtg. 6s.	250,000	250,000	1922	M. & N.	125	……
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	101	103
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1932	J. & D.	117	120
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	100,000	1,100,000	1914	F. & A.	102	105
Eighth Av. RR. Co….Cert. indebt. 6 %.	000 000	1,000,000	1914	F. & A.	108	….
42d St., Man. & St. Nich. Av..1st mtg. 6s.	,200,000	1,200,000	1910	M. & S.	116⅛	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	89	……
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	124	125
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	120	……
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	120	121
Second Avenue Ry……Deb. 5s.	300,000	300,000	1909	J. & J.	108⅛	109
Steinway Ry. (L. I.)……1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	116	117
South Ferry RR. Co……1st mtg. 5s.	350,000	350,000	1919	……	110⅛	112⅛
Third Avenue RR……1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	……	123⅛
Twenty-third Street Ry……1st mtg. 6s.	………	………	1909	J. & J.	……	….
Twenty-third Street Ry……Deb. 5s	150,000	150,000	1906	J. & J.	106	108
Union (Huckleberry) Ry……1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	116
‡‡Westchester Electric RR…1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	114

†$1,085,000 in escrow to retire gen. mtg. bonds.

‡$4,850,000 in escrow to retire maturing obligations.

¶$552,000 in escrow to retire 1st and 2d mtg. bonds.

§In treasury, $80,000.

‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Aug 12 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry……1st mtg. 5s.	2,500,000	300,000	1908	M. & S.		….
†Toronto St. Ry……1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M & S.		….

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—Aug 12, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry……1st. mtg. 6s	850,000	810,000	1909	J. & J.	….	….
Empire Pass. Ry……1st mtg. 7s	800,000	200,000	1900	J. & J.	….	….
Greene & Coates St. Ry……1st mtg. 6s	100,000	100,000	1898	J. & J.	….	….
Lombard & So. St. Pass. Ry…1st mtg. 6s	150,000	………	1901	…….	….	….
People's Pass. Ry……1st mtg. 7s	250,000	250,000	1905	J. & J.	….	….
People's Pass. Ry……2d mtg. 5s	500,000	458,000	1911	J. & J.	….	….
People's Pass. Ry……Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	….	….
People's Pass. Ry……Stk. trs. cert. g. 4s	5,698,210	……	1948	…	….	….
Phila. City Passenger Ry……1st mtg. 5s	200,000	200,000	1910	J &	……	….
Philadelphia Trac. Co……Coll. tr. g. 4s	1,800,000	1,018,000	1917	F. & A	……	….
Thirteenth & 15th St. Ry……1st mtg. 7s	100,000	100,000	1908	A. & O	….	….
Union Passenger Ry……1st mtg. 5s	500,000	500,000	1911	A. & O.	….	….
§Union Traction Co……Col tr. 4s.	29,785,000	29,724,876	1945	A. & O.	——	……
West End Passenger Ry…… 1st mtg. 7s.	………	……	1905	……	….	….
West Phila. Pass. Ry……1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	……	….
West. Phila. Pass. Ry……2d mtg. 5s.	750,000	750,000	1926	M. & N.	……	……

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Aug 12 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown……6s.	500,000	500,060	1931	M. & S.	111⅛	….
Central Traction Co……1st mtg. 5s.	875,000	875,000	1930	J. & J	……	……
Citizens' Traction Co……1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	……	……
*Duquesne Traction Co……1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	…	……
*Fed'l St. & Pleas. Val. Jack's Run……5s.	50,000	50,000	1918	J. & J.	……	……
Fed'l St. & Pleasant Valley……Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	……	….
Millvale, Etna & Sharpsburg……5s.	750,000	750,000	1928	M. & N.	110	113
Pittsburg, Crafton & Mansfield……5s.	250,000	250,000	1924	J. & J.	……	….
Pittsburg Traction Co……1st mtg. 5s.	750,000	750,000	1927	A. & O.	……	….
Pittsburg & Birmingham……1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	113
Pittsburg & West End……1st mtg. 5s.	500,000	500,000	1922	J. & J.	..	……
*Pg'h., Allegh. & Manch……Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	….	……
Second Ave. Traction Co……5s.	2,500,000	2,039,000	1934	J. & D.	……	….
Sub. Rapid Transit Railway Co……6s.	500,000	500,000	1918	M. & S.	……	….

Providence R. I.

Date of Quotation—Aug 12 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry……Coupon 5s	50,000	50,000	1910	J. & D.	……	……
United Trac. & Elec. Co……1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	116	118

St. Louis.

Date of Quotation—Aug 12, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baden & St. Louis RR……1st mtg. 5s	250,000	250,000	1913	J & J	101⅛	……
Cass Ave. & Fair Gds Ry……1st mtg. 5s	1,813,000	1,813,000	1912	J & J	107⅛	……
Citizens' Railway Co……1st mtg. 5s	2,000,000	1,800,000	1907	J & J	109	
Comp. Hts. Un. De. & Mer. Ter…1s	1 000 000	000 000	191	J& J	17	

With interest Unlisted

Unlisted With interest

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Aug 12 1901						
Jefferson Avenue Ry............1st mtg. 5s.	270,000	270,000	1905	M. & N.	102	108
Lindell Ry. Co.........................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	108
Missouri RR. Co....	1,000,000	700,000	1918	M. & S.	105	106
†Mound City RR. Co...............1st mtg. 5s.	400,000	300,000	1910	A. & O.	104½	105½
People's RR. Co......................1st mtg. 6s.	125,000	125,000	1902	J. & D.	....	......
‡People's RR. Co......................2d mtg. 7s.	75,000	75,000	1902	M. & N.	......	......
People's RR. Co.................Cons. mtg. 6s.	1,000,000	600,000	1904	J. & J.	......	......
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.......................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	99¾	100¼
‖St. Louis & Sub. Ry.........1st mtg. g. 5s.	3,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry.................Income 5s.	300,000	300,000	......	....	83	84
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	106	108
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	116½	117½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	100	109¾
Union Depot RR. Co.........Cons. mtg. 6s.	5,500,000	1,787,000	1918	J. & J.	121	122
†Controlled by St. Louis RR. Co. ‡Controlled by Union Depot RR. Co. ¶Controlled by Lindell RR. Co. ‖$200,000 in escrow to retire 1st & 2d mtg. §$600,000 in escrow. ††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—June 1901.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	600,000	1915	J. & J.	114	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	117
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	......	95
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	126¾	......
†Metropolitan Ry. Co..................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co................1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126¾	......
†Park & Cliff House RR.........1st mtg. 6s.	350,000	350,000	1912	J. & J.	105¾	107
†Park & Ocean RR...................1st mtg. 6s.	250,000	250,000	1914	J. & J.	115	......
†Powell St. Ry..........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	.....	126
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Aug 12. 1901						
Belt Ry. Co.............................Cons mtg 5s.	500,000	450,000	1920	J. & J.	......	
Columbia Ry.............................1st mtg. 6s.	500,000	500,000	1914	A. & O.	122	......
Eckington & Soldiers' Home 1st mtg. 6s.	200,000	200,000	1911	J. & D.	......	......
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	......	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Aug 12, 1901						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	108	110
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	118	. ..
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	104	105
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,866,000	1932	M. & N.	112	113
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	115	..
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1932	J. & D.	111¼	111⅝
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	115	115½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,860,000	1920	J. & J.	20	..
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1932	A. & O.	80	85
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	119	119½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	110¼	110¾
††No. Hudson Co. Ry. (N.J.). Cons. mtg. 5s	3,000,000	2,378,000	1928	J. & J.	108	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	....	......
Rochester (N. Y.) Ry........... 1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	....	......
St. Paul City Ry.......................Cons. g. 5s.	5,500,000	4,298,000	1937	......	105¼	106
St. Paul City Ry.........................Deb. g. 6s.	1,000,000	1,000,000	1900	......	108	....
†$1,000,000 in escrow to retire 1st and 2d mtg. bds. ‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co. ¶$760,000 in escrow to retire bonds of C. O. St. RR. Co. ‖$87,000 in treasury. §$960,000 res'ved to redeem prior liens ††$620,000 in escrow.						
					*With int'rs	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—Aug 12, 1901.						
Delaware Gas Lt. Co.,..........1st m. 5s, g.	800,000	800,000	......	J. & J.	106	108
Edison Elec. Illuminating Co., Boston...	2,026,000	......		Quar.	157	...
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	116	.....
Pittsburg Pa						
Date of Quotation—Aug 12 1901						
Allegheny County Light Co............. 6s.	500,000	......	1911	J. & J.	110	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Aug 12 1901.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	109	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1998	......	124	......
Edison Elec. Illg. Co. (Brooklyn).......	5,000,000	5,000,000	1940	....	122½	124
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	. ..	......
Kings Co. El. Lt. & Pow. Co. 1st mtg. 5s.	2,500,000	.....	1937	A. & O.	100	103
Kings Co. El. Lt. & Po. Co. pur. money 6s	5,176,000	....	1997	A & O.	120	122
Milwaukee El. Ry & Lt. Co. 1st con. g. 5s.	8,000,000	....	......	F. & A.	102½	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Aug 12 1901					100¼	101
American Bell Telephone.....................4s.			1908	F. & A.	......	...
Northwestern Telegraph Co................7s.	....	......	....	......	....	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	114	115
Chesapeake & Potomac Teleph. Co... 5s.	....	......	1911	J. & D.	108	106

ALLIED INDUSTRIES.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Aug 12 1901.						
American Electric Heating............. 7s	500,000	500,000	....	....	....	......
Armington & Sims Engine Co..............	....	....	......	......	......	25
Barrney & Smith Car Co......................6s.	....	....	1942	J. & J.	106	107
Carborundum Mfg Co..........................6s.	......	....	1904	J & D.	......	......
Worthington Pump Co.....	75,000	....	......	......	115	127
*Unlisted †Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 16⅝@16¾c.; Lake, 16¾@17c.; casting, 16½@16¾c.

Plans for making full-paid Electric Company of America stock will again be considered this fall.

The Norden-Bitter Electric Company of New York was incorporated on Monday with a capital of $100,000.

The electric road to be built, fifty miles from Little Falls to Oneida, N. Y., is regarded as a link in a chain from Buffalo to Albany.

Business failures in the United States last week numbered 173, against 177 the same week last year; in Canada there were 31, against 23 last year.

The National Carbon dividend of 1¾ per cent. on the preferred stock recently declared is payable August 15. Books closed August 5 and reopen August 16.

An official of the Chicago Union Traction Company says that, in his opinion, the time when dividends will be resumed on the preferred stock is not remote.

The Schenectady Home Telephone Company, capital $250,000, has been incorporated, to operate independent telephone lines in Schenectady County, N. Y.

The Pratt & Whitney Company has declared the regular quarterly dividend of 1½ per cent. on its preferred stock, payable August 15. Books closed August 10 and reopen August 16.

The Washington and Annapolis Electric Railway Company has decided to increase its capital stock from $1,500,000 to $2,000,000 by the issue of 10,000 additional shares of stock of the par value of $50 each.

The Thompson-Houston Electric Company has failed to secure a preliminary injunction restraining the Exeter, Hampton and Amesbury (Mass.) Street Railway Company from using the so-called Condict patent.

A director of the Electric Storage Battery Company says that no proposition from the General Electric Company has come before the board, and he is not cognizant of any overtures looking to a merger or otherwise.

The United Traction Company of Albany, N. Y., reports for the five weeks ending August 3: Gross earnings, 1901, $154,976; 1900, $143,075; increase, $11,901. The Albany Division showed a gain of $8,254 and the Troy Division a gain of $3,647.

International Bell Telephone Company, Limited, of New York, has certified to the Secretary of State a reduction of capital stock from $750,000 to $500,000. The company's debts and liabilities are $54,000. Stockholders are to receive $25 in cash in exchange for each certificate of new stock.

The American Telephone and Telegraph Company reports for the month ended July 20: Gross output, 56,526; returned, 30,241; net output, 26,285. From December 20 to July 20: Gross output, 526,449; returned, 224,810; net output, 301,639. Total outstanding, 2,254,455.

The following are quotations for some of the industrial stocks not quoted elsewhere: Electrical Lead Reduction, 1⅝@2¾; Electric Boat, 17@20; Electric Vehicle, 5½@7; Tel. & Tel. Company of America (full paid), 3@6; Electric Company of America, 7@7¼; National Carbon, 17¼@17½.

It is reported that the General Carriage Company of New York, which is now in the hands of a sheriff, will be reorganized. An order was filed in the Court of Chancery in Trenton, N. J., on Monday appointing William G. E. See receiver of the company for New Jersey. O. F. Thomas has been appointed receiver of the property in New York State.

The property of the Toledo (O.) Traction Company has been transferred to the Toledo Railways and Light Company, which is controlled by the Everett-Moore syndicate. The consideration was $9,000,000. It is officially announced that the latter syndicate has purchased the Toledo, Fremont & Norwalk Street Railway Company. E. W. Moore denies the report that his syndicate will unite with the Widener-Elkins syndicate of Philadelphia.

The city of Chicago has retained ex-Judge Shope as special counsel to represent the city in the case brought by the Union Traction interests to maintain their claim of a 99 year right to the streets. This suit comes up in September. If the traction people should win, it would take entirely out of the hands of the city council the franchise question, the agitation of which has so depressed street railway securities there for several years. The city will retain other private counsel.

Reading and Southwestern Electric Railway stockholders have agreed to lease their road to the United Power and Transportation Company for 999 years, says the Philadelphia "Stockholder." The latter is to pay the interest on $100,000 bonds, and an additional rental of $15,000, sufficient to pay 12 per cent. on the par of Reading and Southwestern stock. In case of default the United Company forfeits a bond of $20,000 and in addition agrees to pay $50,000 damages. Stockholders of the Mohrsville and Adamstown Company will meet this week to vote on the question of their selling to the United Company.

Interests identified with the Metropolitan Street Railway Company of New York say that the persistence with which rumors that the dividend of 7 per cent. is not being earned is getting rather tiresome. The earnings are increasing largely and steadily and there is no danger whatever of any reduction at any time; the only question in regard to Metropolitan's dividends is as to when the ever-increasing business will justify payment at a higher rate as dividends are being more than earned. For July it is claimed earnings have shown an increase of $60,000 as compared with July last year, the improvement being shown on practically all lines. The Huckleberry system and the Third Avenue line generally are showing up very well and indications are for enormous traffic development above the Harlem River. Third Avenue earnings, it is claimed, can amply take care of the property now and of the guaranteed dividends when the time comes for payment of such.

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EDITORIAL NOTES.

The Glasgow Engineering Congress. According to advices from England very elaborate preparations are now in an advanced state for the holding of the great Engineering Congress at Glasgow from September 3 to 6. The Congress ranks very highly among the engineering events of 1901, by reason of the fact that it is a joint affair, with which between twenty and thirty English and Scotch engineering societies are connected; foreign countries are also to be represented at the Congress by Government delegates, delegates of societies and representative engineers. Lord Kelvin is the honorary president, and Mr. James Mansergh, F.R.S., the president of the Institution of Civil Engineers, will act as president over the proceedings. The mornings will be devoted to the consideration of papers, many of which are of direct electrical interest. The afternoons are set apart for the visitation of electrical and engineering factories and works in the Glasgow district. There are to be nine different sections, and we may just briefly mention the titles of the electrical papers. In the Railways Section, Prof. C. A. Carus Wilson will discuss "The Economy of Electricity as a Motive Power on Railways at Present Driven by Steam." In the Mechanical Section there is to be a joint paper by Hon. C. A. Parsons and G. Gerald Stoney on "Trials of Steam Turbines for Driving Dynamos;" also a contribution by Messrs. J. Crighton and W. G. Riddell on "Power Required to Drive Marine Engine Works and for Electric Lighting." Mr. Gisbert Kapp will refer to the "Rating and Testing of Electrical Machinery," and Mr. R. Lenke to "Some Experiences and Results Derived from the Use of Superheated Steam in Engines." In the Iron and Steel Section there is to be a paper by Mr. B. H. Thwaite on the "Profitable Utilization of Power from Blast Furnace Gases." In the Mining Section, Mr. Sidney F. Walker will refer to "Alternating Currents and Their Possible Application to Mining." A paper on "Recent Tramway Practice," by Mr. James More, will come before the "Municipal Section. The Gas Department will hear a paper on "Electrolysis of Gas Pipes," etc., read by Dr. Leybold of Hamburg. Coming now to the Electrical Section, which will be under the chairmanship of President Langdon of the Institution of Electrical Engineers, there are the following arrangements: "Notes on the Electrical Exhibits at the Glasgow Exhibition;" "Electricity Supply Meters of the Electrolytic Type," by Mr. J. R. Dick; "The Relative Advantages of the Three, Two and Single Phase Systems for Feeding Low-Tension Networks," by Mr. M. B. Field; "Modern Commutating Dynamo Machinery, with Special Reference to the Commutating Limits," by Mr. H. M. Hobart; "The Protection of Trolley Wires," by Prof. A. Jamieson; "Kelvin's Electric Measuring Instrument," by Prof. M. Maclean; "Continuous Current Dynamo Design," by Mr. H. Mavor; "The Use of Electricity in the Propulsion of Road Vehicles," by Mr. A. R. Sennett, and "High Speed Railways," by Herr Lasche, of Berlin.

About a week after the Engineering Congress closes the British Association for the Advancement of Science opens its yearly convention. A few particulars have already been announced regarding the papers, but it will not be surprising, says our London correspondent, if everything of a special or striking nature in practical electrical engineering comes before the Congresses earlier in the month.

* * *

Automobiles in Europe. Some very interesting information touching the progress of the automobile industry in various countries of Europe has been received by the State Department. The claim is made that the era of the autombile, whether propelled by steam, petroleum, or electricity, dates from that day in 1894 when the competitive trial of automobiles from Paris to Rouen was made. Since that time the industry has developed in an extraordinary manner in France, there being at present in that country 12 large manufactories of automobiles, with a total capital of over $19,300,000, and employing 15,000 workmen.

The progress of automobiles in Germany has been slower. There are not more than 24 private motor vehicles in Berlin, although for cabs and delivery wagons they have come into more general use. In order to promote the development of this industry, constructors have decided to organize a permanent exposition in Berlin. Mannheim, with its automobile club, is the only German town where this industry has made any progress.

Belgium is to-day one of the principal countries using these vehicles. Their high price makes them still an article of luxury, but they are becoming more popular every day. Last year there were at least 300 automobiles of different types in Brussels and it is safe to say that this number has since increased 25 per cent. There are 16 or 17 establishments in Belgium engaged in the manufacture of automobiles, the most important being the national manufactory of firearms at Herstal, near Liege.

The motor vehicle industry is just commencing in Austria; it has only been two years since the vehicles were permitted to circulate in Vienna, where an automobile club was established in 1899. There are already a certain number of manufactories established, one in each of the following places: Vienna, Baden, Nesseldorf, Prague, and Pilsen. Budapest has no manufactory, but an increasing number of vehicles is imported. Up to June, 1900, only two automobiles had been imported into Greece, both at Athens. Italy has two manufactories of autombiles in Milan, and one just established in Rome. A certain number of vehicles of foreign make has been introduced, and this industry promises to have a fine future.

Automobiles made their first appearance in Spain in 1898, but none are manufactured there. Portugal, on account of the hilly nature of its chief towns, does not offer a good field for this industry. In Russia the bad roads are also an obstacle. Holland, with its level roads, would be an ideal country for automobiles. There are several manufactories, the capital invested in the industry being estimated at $772,000. Sweden offers a good market for a suitable and cheap machine.

The law has hindered the development of automobilism in England, which is far behind the United States and France in this respect.

The German Minister of War has recently ordered some automobiles provided with two small pieces, Maxim system, protected by nickel plates; some automobile breaks for the staff with tables for unfolding maps, and some small vehicles to examine the tests of polygonous cannons.

The automobile trip recently made in the Sahara will have a practical result. The French Government, convinced that the Desert of Sahara is accessible to automobiles, is going to organize a service of control and revictualing by motor vehicles for the distant posts of southern Algeria.

* * *

Copper. The "Chronicle" of Chicago recently printed some interesting statistics received from Houghton, Mich., regarding the output of copper from the Lake Superior mines. Among other things it was stated that the output for the calendar year 1900 was less than for the year 1899.

The difference is said to be 5,346,525 pounds, or about 2,673 short tons of refined copper.

Though the decrease from the Lake Superior mines has been considerable, there is no reason to doubt that the product of all the mines in the world was greater last year than ever before.

A quarter of a century ago most of the copper produced in North America came from the Lake Superior mines. At present those mines, though they yield far more than they did then, supply less than one-thirty-fifth part of the North American product.

The great increase in the world's output of copper began, as is well known, simultaneously with the advent of electricity as motive power. The enormous increase in the supply of copper is to a great extent due to the universal use of the electric current for the propulsion of vehicles.

The supply of copper, though increasing, is not keeping pace with the demand, which bids fair to increase at a still greater rate in the future and for an indefinite period.

A fortune, therefore, awaits the man who can find some way of economizing copper used for conveying electric current or of increasing the conductivity of iron or steel at small cost.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

The first meeting of the convention of the American Institute of Electrical Engineers was held as scheduled on the 14th inst., at 12 West 31st street. At this meeting the French engineers, consisting of Messrs. Janet, Courbier, Boy de la Tour, Debauve, Aubert and Roux, were welcomed in speeches delivered by Messrs Steinmetz, and Mailloux. A luncheon followed. On Friday the party visited the Edison power house at 38th street and East River, from which point all took a special boat to water-front stations of the Manhattan Railway, Metropolitan Street Railway, New York Edison Company, and Brooklyn Edison Company. Luncheon was served aboard the boat. The guests had a day for "personal visits" on Saturday. On Sunday the party went up the Hudson to Albany by boat, and visited the Schenectady plant of the General Electric Company on Monday. As we go to press the session in Buffalo is being held.

The first motor funeral on record in England took place August 15 at Coventry, on the occasion of the burial of an old employe of one of the automobile companies. The hearse was a specially constructed six horse-power car.

What is said to be the first planning mill run by electricity in this country began operations last week on Goose Island, near Tonawanda, N. Y. Two motors of 125 horse-power each were installed and these suffice to run all the machinery in the mill. The owner thinks he will make a great saving in fuel by substituting electricity for steam, as he uses power only according to the machines operated.

The Niagara Falls Power Company will have 10,000 additional horse-power available for use in Buffalo this fall at the close of the Pan-American Exposition, and the indications are that it will all be taken up in short order. That will mean the use in round numbers of 30,000 electrical horse-power from the Falls in Buffalo. The total horse-power which the company will then be in a position to supply to Buffalo, Niagara Falls, Lockport and the Tonawandas will be 60,000. If that is not sufficient to supply the demand, the company, by simply carrying out its present plans, can place 35,000 additional horse-power on the market, or a grand total of 95,000.

An ingenious mail service system has been devised by a Massachusetts inventor. The arrangement is quite complicated, but the manner in which the mechanism works is described as beautifully simple. Letters, instead of being placed in the ordinary boxes, are dropped into receptacles, which are conveyed by electrical motors to the central station. Swiftly and noiselessly these mail boxes move through the air, stopping at regular intervals for more mail, their arrival at and departure from each point being timed as exactly as under the present system. In a word, they are designed to do the greater part of the work that postmen do at present. Of course, by this method, though letters can be transmitted to and from any point in a city, or perhaps a greater distance, they cannot be delivered at individual houses. On the other hand, it is claimed that, so far as time is concerned, these electrically-propelled mail boxes are far superior to any system now in use.

The Brooklyn Rapid Transit Company intends to resume the running of trains on the elevated railroad system by electricity about September 1.

At the semi-annual meeting of the London, Eng., District Underground Railway directors the chairman, T. S. Forbes, referring to the deadlock regarding the equipment of the road with electricity, said that Mr. Yerkes, with his engineers, was now at Budapest. Mr. Forbes said he should not be surprised if Mr. Yerkes brought back Gans, the inventor of an electric system for railroads. Mr. Forbes also announced his own resignation and the selection of Mr. Yerkes' attorney, Robert W. Perks, M. P., to fill the office of chairmen.

According to an article in the "Comptes Rendus," the use of the Roentgen rays on the body sometimes gives rise to mortification of the skin. When the tubes are driven by influence machines it does not happen, but then the activity is reduced, and the presence of moisture and the necessity of an earth connection may prove to be inconvenient. The difficulty, however, would appear to have been sucfully met by one Demerliac, says the London "Electrical Engineer," who has found that tubes worked by alternate currents of high frequency and high tension never produce erythema, and that, on the contrary, the rays so obtained possess the curative properties recognized in electro-therapeutics since the experiments of D'Arsonval, Oudin, Dourner and others. He, therefore, employs the Oudin resonator, which, with certain precautions, may be made to work X-ray tubes. They light up on connecting them with the upper knob of the apparatus. A broad concave cathode and a small anode or an annular anode are used. The cathode is joined to the resonator, and the anode may be left free or put to earth. The discharge is most effective when it proceeds in one direction only. A cathode valve should, indeed, be useful. The tubes may be brought quite close to the skin without risk, and thus any loss of penetrative power is effectually counteracted.

Two Americans, Messrs. Anchor and Friars, have made a daring ascent in the Alps of the Great St. Bernard, from Martigny, in an automobile, to the amazement of the monks, such a feat never having been attempted before.

General Manager J. J. Wood, of the Fort Wayne, Ind. Electric Company, has perfected an invention which is expected to bring riches to him. Mr. Wood has been at work for a number of years experimenting, studying and working on his lamp and its complete success, demonstrated recently before representatives of the General Electric Company, has made him a happy man. The test, it is reported, was severe, thorough and satisfactory in all respects. As a result Mr. Wood will place a heavy order for the manufacture of his lamps.

A REPORT from Berne, Switzerland says that the International Literary and Artistic Copyright Congress recently adopted a resolution declaring that the unauthorized reproduction of music and theatrical works by means of the telephone, phonograph or moving picture machines is illegal.

A SERIES of experiments has lately been conducted in France by M. Michelin with different kinds of pneumatic tires for electric cabs, says the "Electrical Engineer," London. The conclusion to be drawn from the results of these tests apparently is that there is a considerable saving of electrical energy, together with a gain of speed, in the use of pneumatic tires for electric automobiles. In the first place, an electric cab was run a distance of about 1¼ miles on a hard, smooth road with ordinary wheels at an average speed of 13.94 feet per second, and the electrical energy consumed in the journey amounted to 1,037,680 watt-seconds. The same cab, with four pneumatic tires, performed the same journey on the same day and at the same speed for a consumption of 817,840 watt-seconds. In a somewhat similar trial the use of pneumatics led to a saving of 17.9 per cent. in energy and a gain of 5.3 per cent. in speed.

A CONVENIENT form of motor plow has been designed by Conrad Meissner of Friedrichsburg, Germany. It consists of two electric motors operating winding drums on separate carriages, which may be placed at any required distance apart, only one motor being connected with the main feed wire. To supply power to the second motor a feed cable lying parallel with the traction cable is readjusted at every trip of the plow to follow the latter down the field. The mechanism is so adjusted that when once set in motion the apparatus practically operates itself, moving the carriages forward at the beginning of each trip to bring the plow shares in position for the next row of furrows. The plows are attached to a two-wheeled truck, which is pulled back and forth across the field, moving forward at the end of each set of furrows as long as the power is turned on.

DURING a thunderstorm at any time of day the lights in the trolley cars of the Metropolitan system are always turned on by order of the company, says the Kansas City "Star." There are two reasons for it. One is for the protection of the car and the other for the protection of the passengers. When the lights are on and the car is at a standstill the trolley pole becomes a lightning rod. When a car is in motion the electric current, which leaves the power house and is carried along on the trolley wire, passes through a wire in the trolley pole, into the motors of the car, setting them in motion, and then down through the wheels into the rails, by which the current returns to the power house. Thus the trolley-wire, the car and the rails form a complete circuit. When the car is at a standstill the connection between the trolley and the motor is cut off, breaking the circuit. However, turning on the lights has the same effect as putting the car in motion; that is, it completes the circuit.

IT is claimed that present methods of deep sea fishing will be revolutionized by the use of the Yale submarine arc light invented by Francis G. Hall, Jr., and Irving A. Burdick, of New York, graduates of Yale, in the class of 1900. Their submarine lights have been used successfully already in diving work. Arc lights placed on four specially constructed boats built for W. S. Meade, of New York, will test the theory in the Pacific Ocean, off the coast of California. Electric lights, it is asserted, not only fascinate big fish, but even blind them long enough to enable strong nets to gather in schools of them. The ultra violet rays given off by electric arc lights, stun the fish, because of the great dependence they place on their sense of sight. Four submarine arc lights are to do the work of fishing on each of the boats. Each lamp will be of several thousand candle power. Besides the fishing apparatus each vessel will have a complete electric plant, consisting of a dynamo connected with a new type of petroleum engine, placed near the main engine, thus permitting one engineer to run them both, a portable naval searchlight projector to be used in picking up buoys, six naval portable deck arc lamps for illumination, lamps about the deckhouse and hold, and a storage battery to operate the sparking apparatus on all the engines.

THE gentleman who writes for "Electricity," London, under the non de plume of Elektron, says: "M. Henri Becquerel, whose name will be familar to my readers in connection with the rays which bear his name, is said by our contemporary, the 'X-Ray Journal,' to have experienced a Becquerel burn. According to our contemporary, he started on a journey with a piece of radium in his pocket; the rays penetrated a cardboard wrapping and the material of his clothing, and caused burns to make their appearance in the space of two weeks. Strange as it may appear, I have noticed a similar development in connection with gold. I once started on a journey with a sovereign, which in far less than two weeks, or even two days, burnt a hole in my pocket, but, unlike radium, did not affect the skin."

A CABLE dispatch from London says that tapping wireless telegraphy messages proves to be so easy that if privacy is to be secured under the new system everything will have to be in code. Two striking examples of the way these wireless messages go floating through the air recently occurred. When the German squadron was manœuvring off the coast of France a telegraph station near Ushant heard many messages that passed between the ships. A more striking case occurred during the British manœuvres, when one admiral learned all the plans of the opposing squadron by tapping messages of instructions sent by the other admiral to his captains.

CAN an employer appropriate the invention of an employe to whom he has given the idea of same? is the somewhat ticklish query submitted by "Engineering." The answer appears to be in the negative. This is the way in which our contemporary works out the problem. The writer says: "If the employer has only mentioned his idea to his workman, and asked him to devise a mechanism to put it in practice, the invention will belong to the workman, and not to the master. Before a patent can be granted the applicant must make a declaration that he is the 'true and first inventor' of that which forms the subject of the application; and since the bare idea, which is all that the master has provided, cannot form the subject of an application, it is clear that he is not the 'true and first inventor,' and the patent will be granted to the workman."

NIKOLA TESLA is said to have closed a contract for the erection of a building and plant at Wardenclyffe, on the Sound, 9 miles east of Port Jefferson, N. Y., for the principal station of his wireless telegraphy system. The purchase includes 200 acres of land, and Mr. Tesla says he will put up the largest building of its kind in the world for his experiments. With his usual optimistic spirit, Mr. Tesla says he expects to converse by electricity with all countries of the world from Wardenclyffe.

AN invention which, it is claimed, will supplant petroleum as a motive power and will make stopping to take on a supply of electricity unnecessary for automobiles, is the work of a French scientist, one S. North. The device, according to an English contemporary, consists of an automatic generator of electricity which takes up very little space, and makes electricity as the automobile proceeds on its journey. Only a small quantity of water is required for generating the electricity, and this can be easily carried in a bottle. It is stated that the French Government has under consideration the advisability of adopting this new invention for submarine boats.

THE division of soils of the United States Department of Agriculture has just described a new instrument now in use for investigating the properties of soils. This is a great time and labor saving apparatus, giving accurate and reliable results, which otherwise would require months to obtain. The new apparatus as devised by the division of soils is an electric affair. It registers a half dozen or more various soil properties. This method depends upon the principle that the resistance offered to the passage of an electric current from one carbon plate to another buried in the soil depends upon the amount of moisture present between the carbon plates or electrodes.

American Association for the Advancement of Science.

The fiftieth meeting of the American Association for the Advancement of Science is to begin at Denver on August 26. The meetings at Denver will be held in the Denver High School. There are several changes to be proposed in the organization of the society. One is to give the permanent secretary a salary of $5,000 a year, or else to provide him with salaried assistants to do the increasing routine work of the association. There is also an idea of changing the time of meeting of the association from the summer vacation to the Christmas holidays. The principal address to be made at the meeting will be that of the retiring president, Professor R. S. Woodward, of Columbia.

PAN-AMERICAN SCENES AND EXHIBITS - VI.

BY FRANK C. PERKINS.

The Government Buildings at the Pan-American are of beautiful architectural design, as will be noted by the accompanying illustration, Fig. 1, which gives a good view of the main building with the East Esplanade fountain basin in the foreground. The electrical decorations of this building and that of the Ethnology Building are of particular interest—the night illuminations of these buildings being seen in illustration, Fig. 2.

Most of the large guns used by the Government, both in the navy and in the coast defense, are electrically operated, being trained and moved from one position to another by electric power, various sized motors being used for handling the large guns, conveying the loaded shells and removing the empties, while electricity is also used extensively for sighting and firing the guns, operating the searchlights, etc., as recently described and illustrated in ELECTRICITY.

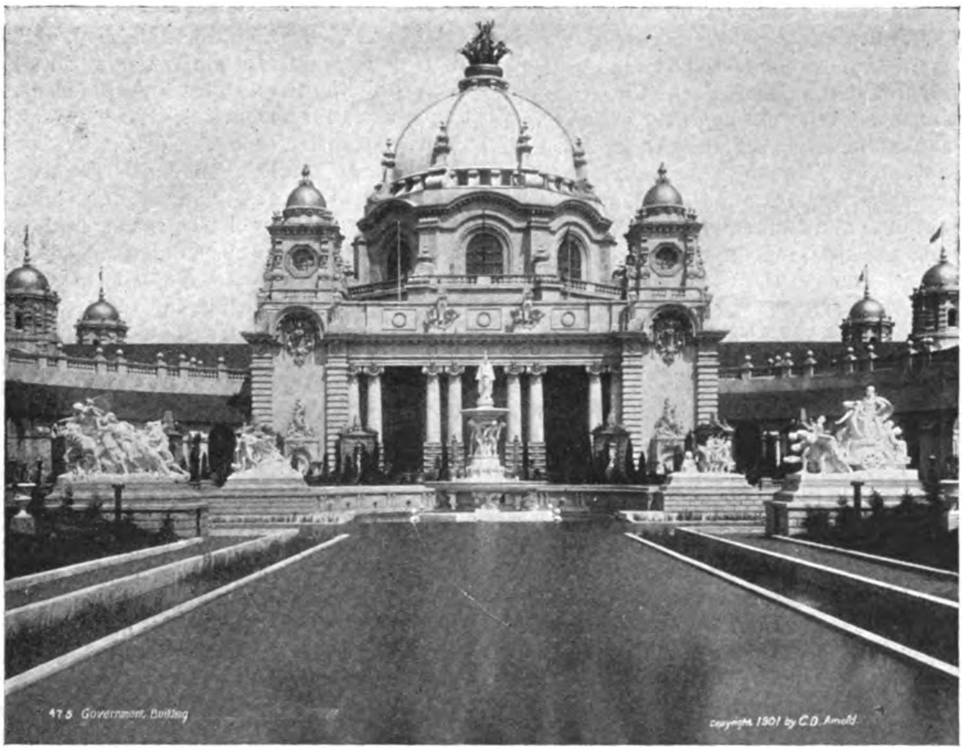

FIG. 1.
Government Building and East Esplanade Fountain Basin, Pan-American Exposition.

One of the most interesting of the Government exhibits is that of the complete working model of a large coast defense turret in the Ordnance Building of the Pan-American Exposition. A large sectional model is also shown outside of the Ordnance Building, as seen in the accompanying illustration, Fig. 3. A part of a revolving Gruson turret for coast defense is shown with two 12 inch guns. Five of the armor plates have been removed in order to show the construction and arrangement of the interior and one of the large guns exposed to view. The section is seen of the armor plate, 8 feet 5 inches long and weighing 84,000 pounds. This armor plate is constructed of chilled charcoal iron. This method of coast defense is in use in the various countries of the world, including Germany, Austria, Italy, Holland, Belgium, Brazil, Switzerland and Roumania, and is accepted as the most approved practice.

The other Government exhibits in the ordnance department are particularly interesting, while the navy and army exhibits in the main Government Building have received a great deal of attention. The Postal Department and Department of the Interior have some of the most complete novel exhibits at the Exposition and were in excellent shape long before the Manufacturers, Machinery or Electrical Buildings were in a presentable condition.

The fisheries Government exhibit is attracting more attention than any other one shown, and the building is crowded from morning until closing at 5 P.M. The aquarium and hatcheries exhibits are well attended and are in charge of men who take the utmost pains to explain the details and give any information desired by visitors.

The interior view of the Machinery Building, shown in illustration, Fig. 4, was taken from near the center of the building looking northwest and includes a number of the automobile exhibits, while the interior view of the Electricity Building, seen in Fig. 5, shows several of the most important exhibits, including the General Electric, Stanley, Northern Electric, Crocker-Wheeler and Thomas A. Edison, the signs of the latter, as well as those of the Kellogg Switchboard Company and Westinghouse, appearing in the background.

* * *

A Sparrow's Adventure in a Dynamo Room.

An English sparrow flew into the dynamo room of the power station of an electric light company in New Jersey in the afternoon, and frightened by the roar of the machinery it attempted in vain to fly out the windows, which were closed by nettings. In one of its flights it saw the open door at the other end of the room. Between the sparrow and the door was an 18-foot flywheel, revolving at 90 revolutions a minute. Its speed was so great that the arms of the flywheel could not be seen. They simply looked like a gray haze. The sparrow attempted to fly through the haze and was caught in the wheel. It looked like a gray ring on the inner circumference of the big wheel. The engines were not stopped until 8 o'clock the next morning, when the sparrow—so the story runs—was taken out alive with its feathers dripping with oil.

* * *

MISCELLANEOUS NOTES OF INTEREST TO CENTRAL STATION MEN.—IV.

BY W. H. WAKEMAN.

Every engineer knows that a tight belt will cause a bearing to heat unless it is well lubricated, but when a belt has been running loose for some time and is then made tight he may not remember to watch the nearest bearing until he knows that it will not heat, unless reminded of the necessity for so doing, and failure to give it due attention at this time may result in causing the babbitt in the boxes to be melted out.

It will do no harm to test the nuts on the foundation bolts of your engine occasionally, in order to be sure that they are not working loose.

I do not advocate the waste of oil or other supplies, but at the same time it pays to provide a plentiful supply for every bearing in a steam plant. This does not mean that large quantities of oil should be poured into every bearing daily, only to run out on the floor, but it does mean that where means are provided for pumping the oil out of a drip pan upon the shaft, after which it falls back into the pan again the friction is reduced to a minimum, and this means less coal for the furnace and less wear on the boxes. My attention has been called to this subject again by noting that the boxes on a dynamo which has been run for five years show but slight wear, and there is a good chance here to tell just how fast the babbitt does wear. Ring oilers are provided which deliver a constant stream of oil to the bearings whenever the shaft is in motion.

Some ring oilers are much more efficient in delivering oil than others are. If the ring is made heavy enough to be worthy of the name and is in the form of a true circle, it will probably do the work for which it was made, but where a piece of steel wire is bent so as to caricature a circle, sprung over the shaft and allowed to rest on the bottom of the drip pan or oil reservoir, there is a good chance for it to do more harm than good, because it gives the bearing the name of having a ring oiler when in reality it has nothing of the kind.

I notice that several manufacturers of injectors claim to have made many thousands of their boiler feeders and their statements are probably correct. When the number of injectors made by the smaller concerns is added in, the aggregate must be very large. Some people wonder where all of the pins go to that are made, and following out the same line of thought I wonder where all of the injectors go to. This is a very large country and there are many thousands of boilers in it, so that it requires a very large number of injectors to supply all of them, but I am of the opinion that if all of them that have been made in the last ten years had been properly taken care of, there would have been a surplus of them somewhere. This might not have suited the firms who make them, but would have pleased those who buy, and incidentally been a source of satisfaction to those who use them.

If an injector is not as reliable as it was when new, it should be filled with a mixture of muriatic acid and water and allowed to stand for ten or twelve hours. This will remove the scale which has made some of the passages smaller than they ought to be, and will probably make the injector as reliable as it was when new. About three parts of water to one of acid will answer every purpose, as it does not need to be very strong. In some cases this will not cure the trouble, but if it does not there is no necessity for throwing the whole machine away, any more than there is for buying a new engine whenever a part of the old one is broken or worn out. Send it to the makers and get new tubes for your injector, which will make a new machine of it.

The girth seams of a tubular boiler will sometimes leak when the scale is removed which stops up the small crevices, and it may be necessary to have the seams caulked. After this has been done several times the edge of the plate must be chipped off in order to make the caulking effective, but when this fails to keep the seams tight it is time to look for the trouble elsewhere. A defective plate may be responsible for it, or some of the rivets may be worthless, or perhaps the rivet holes do not come "fair," so that the rivets are not given a chance to hold to good advantage.

If there are no defects in the boiler itself there must be some trouble with the management of it. The practice of introducing the feed water through the bottom of the shell causes unequal contraction which will make almost any boiler leak sooner or later. Some plan should be adopted for every boiler whereby the feed water will be discharged into the body of the water already in the boiler, as in this way it becomes well heated before it reaches the plates where it can cause trouble. This rule applies to cases where a good exhaust steam heater is used, as well as where the water is pumped in cold.

A certain engineer, whose plant is run 24 hours per day, has been troubled much by careless men in different rooms who persist in attempts to use more electricity for motors, etc., than his generator was intended to supply. As this generator was badly worn he ordered a new one of twice the capacity of the old, so that now he does not need to caution them about being careful. When they try to use more than is required to do their work in a proper way, the engine slackens its speed and this reduces the tension of the current whereever used. As this is not satisfactory they soon become tired of it and begin to use the current judiciously. I suppose that if the owner of the plant puts in a larger engine, they will find some way to use all of the current available at times, whether it is needed or not.

We are told that when the water in our boilers is evaporated into steam it leaves all of the impurities behind it, but this is not always true, for some of the impurities or the foreign matter will pass out with the steam. I knew of at least one case where the safety valves of a battery of boilers were always leaking, and when examined a thin coat of white scale was found on both valve and seat, which was caused by using soda ash as a boiler compound. All efforts to keep the valves tight were useless, until the use of the boiler compound was discontinued, when the trouble disappeared.

UNINSULATED RETURNS IN A TRAMWAY SYSTEM.*

BY JOHN H. RIDER,

Chief Electrical Engineer London County Council Tramways.

The general regulations prescribed by the Board of Trade, under the provisions of the tramways acts, include, among others, clauses which relate to the employment of uninsulated metallic return circuits of low resistance. Such returns, in the shape of the tramway rails, are up to the present in universal use in this country, and consequently the clauses mentioned are of universal application.

It is provided that the uninsulated return shall be connected with the negative terminal of the generator, and that all parts of the return circuit which do not consist of the rails shall be insulated, unless of such cross-sectional area as will reduce the difference of potential between the ends of the uninsulated return below 7 volts. This is also the maximum pressure allowed between the ends of the uninsulated return furthest from the generating station.

Excepting perhaps that the maximum allowed is too high, no fault can be found with these requirements, as unless the differences of potential be kept low, excessive earth currents will flow, causing considerable damage to any metal pipes in the vicinity. The earth, being more or less a conductor, practically connects all buried metal near the track to the rails. Unless great care be taken, therefore, the return current leaks out from the rails and flows through any other metal which may be lying in the neighborhood of the track. Being no respecter of paths, it has been even known to make use of the lead sheathing of the tramway feeders.

The mere passage of the current through these irregular paths does no harm, but at all points where the current leaves the rails or the pipes or the sheathing, corrosion takes place by reason of electrolytic action. The number of places at which the current flows into or out of the rails or pipes is entirely a question of relative resistances (or of conductivities) between the various paths open to the current, and at each place of leaving corrosion goes on. The only way to prevent leakage currents is to make the proper path of so low a resistance that the difference of potential between any two points is at all times exceedingly small. The requirements of the Board of Trade in this particular are most reasonable, and the engineer who thoroughly appreciates the position, will endeavor to bring the maximum below this amount for other reasons than to comply with the regulations.

In the opinion of the writer, however, some of the other regulations are not only unnecessary, but even undesirable, as for instance those relating to the earthing of the negative bus-bar. Regulation No. 5 says: "When any part of a return is uninsulated it shall be connected with the negative terminal of the generator, and in such case the negative terminal of the generator shall be directly connected, through the current indicator hereinafter mentioned, to two separate earth connections which shall be placed not less than 20 yards apart. Provided that in place of two such earth connections the corporation (or company) may make one connection to a main for water supply of not less than 3 inches internal diameter, etc." Regulation No. 6 says: "When the return is partly or entirely uninsulated, the corporation (or company) shall, in the construction and maintenance of the tramway, (*a*) so separate the uninsulated return from the general mass of earth and from any pipe in the vicinity; (*b*) so connect together the several lengths of the rails; (*c*) adopt such means for reducing the difference produced by the current between the potential of the uninsulated

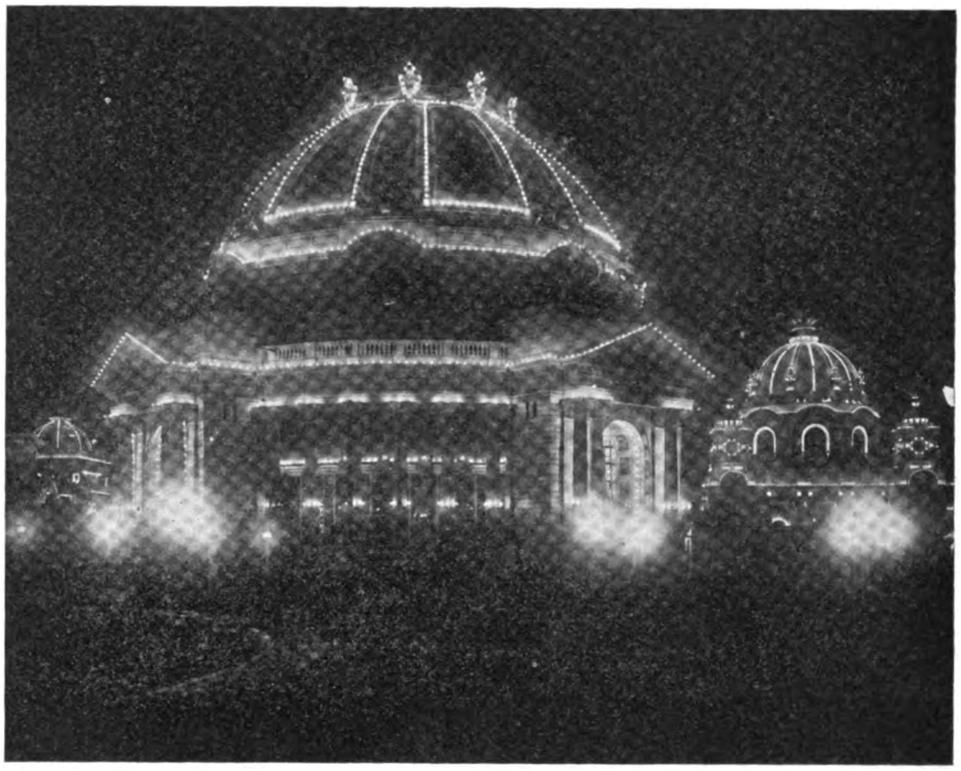

FIG. 2.

Electrical Decorations of the Government and Ethnology Buildings, Pan-American Exposition.

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*Paper read before the Incorporated Municipal Electrical Association of Great Britain at Glasgow June 19-22, 1901.

return at any one point, and the potential of the uninsulated return at any other point; and (*d*) so maintain the efficiency of the earth connections specified in the preceeding regulation (No. 5) as to fulfill the following conditions, viz: (1) That the current passing from the earth connections through the indicator to the generator shall not at any time exceed either two amperes per mile of single tramway line, or 5 per cent. of the total current output of the station. (2) That if at any time and at any place a test be made connecting a galvannometer or other current indicator to the uninsulated return and to any pipe in the vicinity, it shall always be possible to reverse the direction of any current indicated by interposing a battery of three Leclanché cells connected in series if the direction of the current is from the return to the pipe, or by interposing one Leclanché cell if the direction of the current is from the pipe to the return.

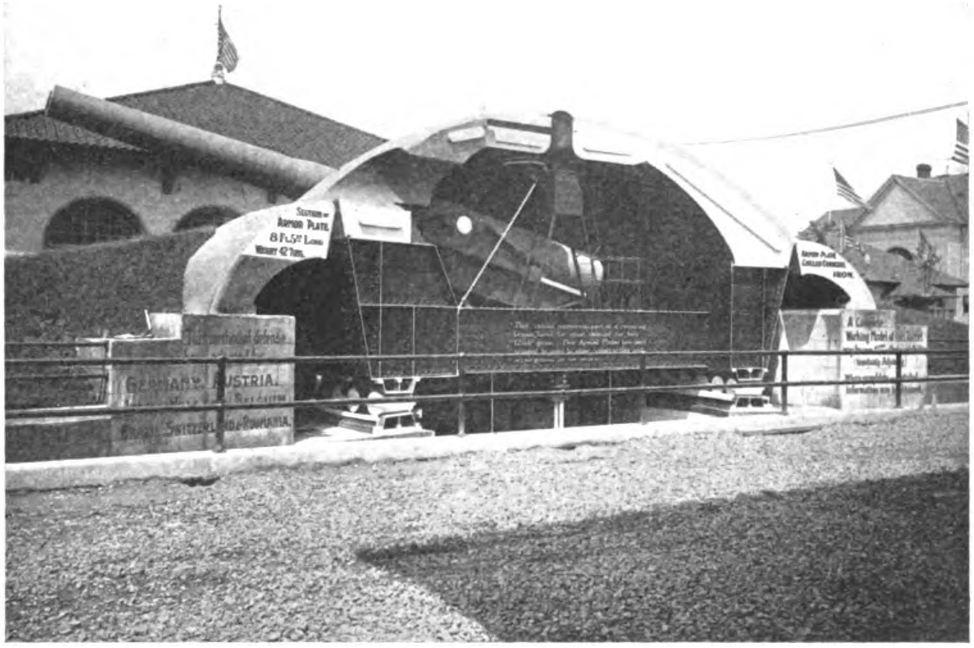
Section of Armor Plate 8 Ft. 5 In. Long Weight 42 Tons
Armor Plate Chilled Cast Iron
GERMANY AUSTRIA

FIG. 3.
Government Exhibit of Model of Coast Defense, Pan-American Exposition.

"In order to provide a continuous indication that the condition (1) is complied with, the corporation (or company) shall place in a conspicuous position a suitable, properly-connected, and correctly marked current indicator, and shall keep it connected during the whole time the line is charged."

Condition (2) is, of course, merely intended to show that the earth connection is maintained in good order.

It will be observed that the current coming back from the rails, via the earth, to the negative bus bar must not exceed a certain value. The strength of this earth current will depend entirely upon two things—(1) the difference of potential between the rails and the negative bus-bar; and (2) the resistance of the earth path. The former is the fall of pressure on the return feeder, which, although it may be only a small amount, from the point of view of economy in transmission, may be enough to send a large current back through the earth, particularly if the resistance of the earth path be low. This may readily happen on account of the existence of water or gas pipes near the return feeder, and particularly when a water pipe is used as the earth plate at the generating station.

In case of the Plymouth electric tramways, where the shortest return feeder is 760 yards long, being connected to the rails at their nearest point to the generating station, the resistance between the rails and the earth plate (water pipe) is only about 0.5 ohm. It was found that 25 per cent. of the return current came back through the earth.

Now, the resistance of the earth path can be made practically infinite by the simple expedient of removing the earth connection from the negative bus-bar.

Regulation No. 6 (1) is apparently intended to protect gas and water pipes, by insuring that no current (or only a very small amount) shall come back through the earth to the generators. Regulation No. 5 practically invites such current, and provides means for its measurement. If the earth connection be re. moved from the negative bus-bar, no current can come back through the earth. Why then should the connection be made?

The Board of Trade regulations appear to provide for an earth connection at the wrong place. When the return circuit of a tramway system consists partly of uninsulated rails and partly of insulated cables, the insulated part should be kept insulated except at the point where it joins the uninsulated part, and there the earth connection should be made rather than at the other end, where it is joined to the negative bus-bar.

With more than one return feeder, negative boosters may be necessary, to keep the points of earth connection at the rails at about the same potential. Earth currents would then be practically non-existent. With only one return feeder no negative booster would be needed, unless it were desired to reduce the fall of pressure for economical reasons. In this case it would depend entirely upon the length of the return feeder, as to whether it would be better to add to its cross section, or to use a negative booster. In the majority of cases the latter would probably prove the better way.

If the ventilation of this subject by the Incorporated Municipal Electrical Association should result in a modification of the Board of Trade regulations, then this short paper will not have been written in vain.

LITERÆ HUMANIORES.*

To make the assertion that a mere man of science may be, and frequently is, "an insipid pedantic character, and ridiculous" in a journal which appeals primarily to men of scientific education, will possibly appear a wanton insult to our readers. The accusation, however, is by no means warranted; we stand behind no one in admiration of brain power, and our sympathies naturally lead us to admire most of all that development of brain power which is made manifest in the explorer of nature's secrets. But at the same time it cannot be disputed that the man of science must always rank below the statesman as a benefactor to his species, and so we arrive at a conception of the ideal hero as the individual who, combining political with so-called scientific knowledge, shall be competent to remove abuses without putting others in their place, and who shall leave the world better to live in than it was before his birth.

In the present state of civilization, and in such a land as Great Britain, the highest post to which the ambition of man can aspire is that of Prime Minister, or leading member of the Cabinet; while to those of us who must always be restricted to a lower grade of the national hierarchy, the positions of similar importance and respectability are general managerships or active directorships in large manufacturing and commercial enterprises, where we shall have the control of capital, brains and labor. But it were idle to assert that the profoundest and most lengthy study of any department of science—or, indeed, of any number of such departments—alone will ever fit a man to adorn a position of heavy commercial responsibility, unless he happen to be one of those "sports" who possess at birth a genius for finance.

Some years ago we remember hearing a highly successful commercialist quote the saying to the technical manager of his works, that while "any fool can make a thing, it takes a man to sell it." This observation may, perhaps, appear to be simply of a splenetic nature, to be entirely ex parte, to be wholly devoid of justice. A little reflection, however, or a little knowledge of the world, will show that it conceals much truth as well as much error; so much truth, in fact, that the lessson it conveys is worthy of most careful attention. We have already urged that qualitative (i.e., non-mathematical) work and pure mathematics are each useless to the man of science; that they should be regarded as the two inseparable halves of the quantitative or mathematical whole; but we have admitted that the former alone will often enable a man to earn his living as another man's subordinate. In a precisely similar fashion, looking at the matter from a wider standpoint, commercial ability and quantitative scientific knowledge are each useless to the man of the world; they are the two halves of the statesmanlike whole; yet the former alone will enable a man to earn his living in a position of considerable affluence, but in one which we are pleased to consider as intellectually and reputably inferior.

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*From the "Electrical Review," London.

It is an undoubted fact that even the best kind of scientific education does not necessarily make for commercial ability. To the man of science himself this fact is mysterious —the very secret of commercial ability is elusive. He often finds business men earning three or four times his own income, impressing their neighbors with a far higher sense of their importance than he is able to do; men who, in all respects save one, are emphatically his inferiors. Before we can ascertain why a scientific education does not foster commercial ability, therefore, we have to attempt an analysis of this quality; to see why there is always that kind of freemasonry of confidence among capitalists to which the expert is seldom admitted. Commercial ability seems to be a rule-of-thumb, or intuitive knowledge of mankind, an unsystematic variety of non-biological anthropology, an acquaintance with men and cities. Commercial ability is the power of impressing an interlocutor with the notion that the speaker is truthful, responsible, and skillful; it involves an instantaneous evaluation of the mental calibre of the interlocutor, a rapid appraisement of his habits of thought, intelligence, and sympathies—maybe of his foibles, prejudices and ignorance. It requires certain histrionic qualities to enable the salesman to respond to the buyer's temperament; to be facetious if he is jocular, intimate if he is familiar, solemn if he is deficient in humor, to be all things to all men. The student of science has to deal with plain facts, and things, which present to him always the same face, not smiling to-day and frowning to-morrow; or which cover their face with the same veil of obscurity, not feigning eagerness to-day and coyness to-morrow. The man of science is like the golfer playing "bogey;" he pits his skill against fate or the law of averages. The man of commerce resembles the golfer in a match competing against a rival of unknown skill; or the whist player with a fallible partner and fallible opponents. To take another metaphor, which carries its own lesson, we may say that the man of science is like the anatomist performing an operation on the dead body which lies always passive beneath his knife; the man of commerce is carrying out vivisection, and is dependent upon his skill in providing anæsthetics to avoid a fatal mistake.

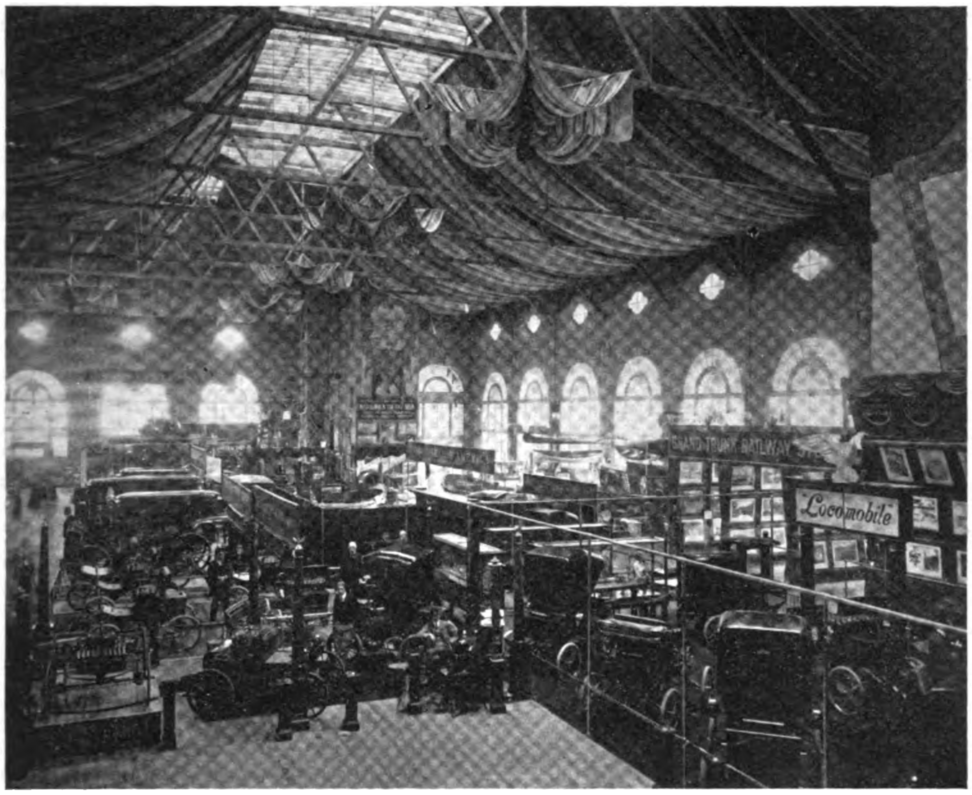

FIG. 4.
Interior of the Machinery Building, Pan-American Exposition.

We have not stopped to labor the fact of scientific education being alone insufficient to equip the man of the world, for it is so painfully obvious. Most of us know men of prodigious depth of mind with very narrow views, men who are unique in the laboratory, who can grasp the scientific bearings of a problem in no time; men who are helpless outside the laboratory, who cannot devise manufacturing processes, to whom the workman is impossible. We also know men who easily control a yard full of laborers or a shop full of mechanics; men who fail to govern an office of clerks and draughtsmen, who cannot get on with their equals, and who quail before the board of pompous directors. The first is the insipid pedant who has not studied his fellow creatures, and who has no appreciation of money matters. The second is the man who has traveled far but not yet attained the fullness of the Pauline dictum. The first must always remain in the laboratory, beneath the second in responsibility, dignity, and remuneration; the second can never emerge from his position of subordination to the ultimate employer and man of the world.

In such circumstances as we have attempted to sketch, it follows that the primary end of education is to teach knowledge of mankind, acquaintance with the powers and limitations of the species, an unerring judgment in moments of critical import; and this is true whether the student be finally intended to become expert, politician, or accomplished man of leisure. But as man can only learn by experience, the word "teach," in our last sentence is not strictly applicable to the case in hand, and we should say that the primary end of education is to promote or stimulate the growth of intellect in such a direction that the student may be able to acquire knowledge of mankind more easily and rapidly than he does by nature. This, we argue, cannot be done by mathematical processes, nor by exclusive attention to mathematics, for that tends to a sort of mental self-sufficiency which is sometimes lamentable in its effects. It cannot be done by a purely classical education, if by "classics" we understand simply Latin and Greek, and if we regard the authors read as teachers of elegant and correct diction or of rhetoric only. It can be done, so far as we can achieve anything completely in this world of compromise, by an education in the "humanities," to use the old Scotch word, by reading Homer, Virgil, Cicero, etc., as text books of human nature, by reading ancient, mediæval, and modern history in order to see the difficulties our predecessors had to encounter, how they surmounted them, what mistakes they made in the process, and how we suffer or benefit from their errors or triumphs. A sound knowledge of history, and of the collective lessons to be learnt therefrom, often called social and political economy, will save us from many absurdities and embarrassments, which no command of mathematics can ever guard us against; in technical directions it will prevent our inventing and waxing eloquent over a device that was patented and proved useless a score of years ago; in more general directions it will warn us from the dangers which lurk in extreme opinions of all kinds. Apart from the intrinsic merit of history, extrinsically it teaches that we had ancestors who failed in the battle of life, or succeeded with a success little better than failure; it shows that man is not omnipotent, and indicates the fatuity of that conceit and unbridled ambition now denominated "hustle." It teaches that what we call the "power" of the species is limited; that if we emit more than so many foot-pounds of energy—be it muscular or be it nervous—per diem, collapse is inevitable. It shows no surprise at the periodical inflations and absolutely consequent panics of the stock markets. It simply demonstrates that each crest of mental or pecuniary delirum must be followed by the trough of pecuniary or mental syncope. It proves that the phenomena of Wall Street are pathological, not physological symptoms. All the various subjects included in the humanities are pertinent to the student of science, extrinsically, if not intrinsically, for they broaden the mind, and by exercising it increase its capacity and logical power. In art, painting, sculpture, music, in pure literature, in poetry, in the dead languages, in every single department of knowledge there is something to be learnt; something which one day may be positively valuable to the man of science, something which assuredly will be valuable to him always as having formed a change in the tedious business of learning how to learn, as having formed an intellectual excursion.

We therefore regard the higher mathematics as precisely equal in importance to all the sciences a man has to study, except the one on which he is to be a recognized expert. We regard a training in those subjects as part of the final specialization of the educational course. And we desire to postpone that specialization to the latest possible moment. Assuming, for the sake of argument, that a well educated youth who is to become a professional electrician can acquire a sufficiently deep knowledge of electricity and the "side lines" of physics, chemistry, and mathematics by four years' steady application, we urge that until the last four or five years before he must begin to earn his living, he be educated simply in the humanities, and that his education be conducted on exactly parallel lines to those adopted in the case of cultured men of ease. We have found one other branch of training so eminently useful to the man of science (because, as we have pointed out, he is so commonly deficient in that knowledge), that we should like to insist upon it also. At some period of the youth's career, preferably, perhaps, just before he begins to specialize, he should serve for a year in some merchant's office as a clerk, not paying a premium for admission, but receiving a salary to which his services entitle him, neither more or less than what he would receive were he intending to remain a clerk all his life. It probably does not matter much what the business is so long as it is well, smartly, and remuneratively conducted; we doubt if there would be much practical advantage in preferring an engineer's office to a bank, or a bank before a wholesale draper's. The great idea of this diversion from ordinary scientific training is to teach the youth business habits, punctuality, conciseness in correspondence, the value of time and money, and a knowledge of mankind.

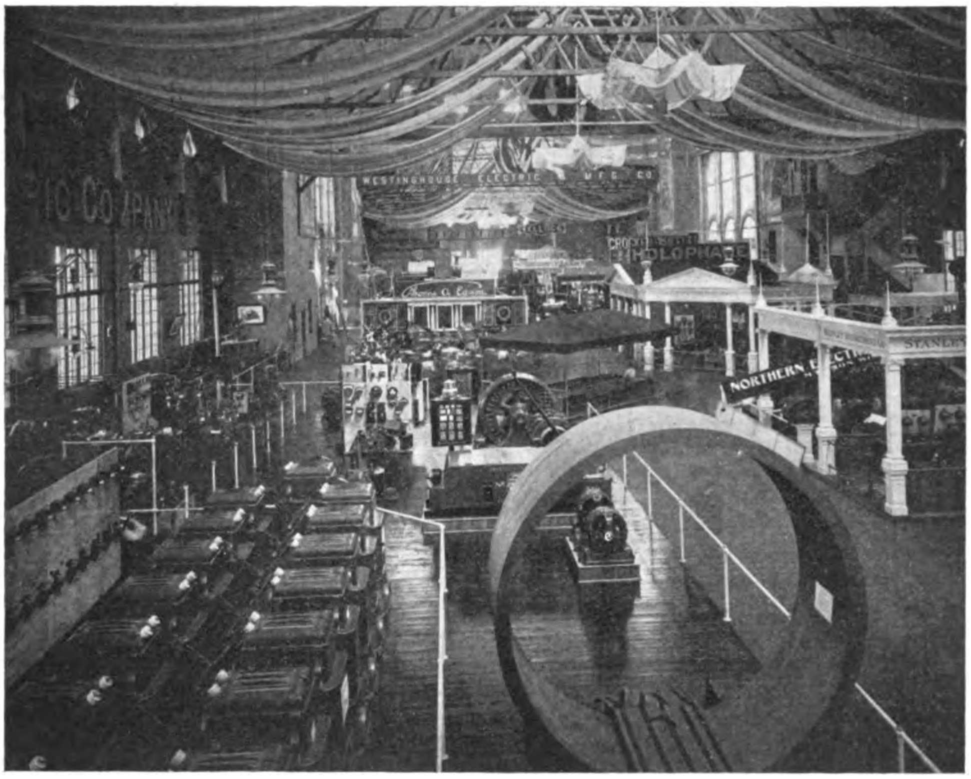

FIG. 5.

Interior of Electricity Building, [Pan-American Exposition, showing General Electric, Stanley, Northern Electric, Thomas A. Edison and other important exhibits.

BALANCING A THREE-WIRE ALTERNATING SECONDARY SYSTEM.*

BY L. DENIS.

This paper has the misfortune of having been prepared under rather short notice; its subject had to be chosen so as to be easily developed, to make the paper as short as possible. In fact the main object of this paper is to open a discussion on the relative merits of the different alternating current secondary systems.

During the past seven or eight years great achievements have been wrought in long distance, high tension transmission, and probably the efforts which these have required may account for the little attention given towards improvements in secondary systems.

Poor distributing regulation is a very common and even accepted occurrence amongst central stations; and this, if not properly checked, may very likely be the cause of a retardation in the electrical progress.

In this paper it is intended to give a short description of the method employed by the Jacques Cartier Water Power Company of Quebec, for keeping a three-wire secondary network in proper balance. Before entering into the subject of secondary distribution proper, kindly allow a short description of the whole distributing system.

As in most distribution of any size, the city is divided into several districts, fed by separate single phase primary feeders (the power distribution being quite separate from the lighting).

In each of these districts is a main bank of transformers connected to feed a three-wire distribution (108 volts on each side). These transformers are separated from one another by properly fused junction boxes in the two outside secondary wires and set midway (electrically) between transformers. The primary feeders are regulated by means of Stillwell regulators from direct pressure readings taken at different points of each of the banks and carried back to the station by pressure or pilot wires, which are strung in the form of a cable and which show the pressure across the two outside wires on a 200-volt voltmeter, which takes a current of only .006 of an ampere. The neutral wire is also carried back to the station in the same cables and arranged on a switch so that the readings on each side of the three-wire system may also be obtained on a standard voltmeter. The outlying districts are fed from independent transformers, with which we are not concerned in this paper.

Coming now to the subject proper and considering an individual consumer—it is essential to know three facts about him before any attempt is made at keeping records:

1. What side of the secondary circuit the connection is made on.
2. What transformer in the bank the connection is made on.
3. What his approximate maximum demand will be.

Knowing these for each consumer, it is quite simple to arrive at the maximum demand on each side of every transformer, and a record thereof may be kept.

The method employed by the above-named company to ascertain these three facts is as follows: For each consumer to be connected a form is filled out giving the name and address of consumer; from his address the transformer he will be fed from is determined and put down, and by referring to records for this transformer, the best side to put consumer on is also determined and put down. The slip thus filled out is handed to the foreman of a service connection gang, who has to go by it in running the service wires, and returns it to the office as soon as he is through. If however, for some reason or another, he finds it impossible to follow the slip to the letter, he is instructed to make whatever alterations are necessary, so that when the slip is handed back it shows the actual manner in which the consumer has been connected.

Now, going into further details about the three points above enumerated, little need be said about the first, except describing the manner in which one side of the secondary system is distinguished from the other.

The three wires are strung on a four-pin cross-arm, using three consecutive pins, the same relative position being maintained all along the bank. This construction will give you at each pole the same two wires (one outside and the neutral) separated by the pole and the other two (the other outside and the neutral), with nothing between. These two sides may be designated as "a" and "b" or "1" and "2," or any other convenient symbols respectively.

It is evident that great care must be taken in running three wire taps from a main line not to have circuit "a" of your tap connected on circuit "b" of the line and circuit "b" of tap on "a" of line, as this is certain to give rise to very serious errors.

To determine the second point, maps of the different districts of the city are maintained and kept up-to-date, as far as changes on the lines are concerned. These maps show the secondary line and taps and the exact position of transformers and junction boxes. Knowing a consumer's address, his exact location is ascertained with the help of a city directory and the transformer feeding the nearest mains determined. The transformers are distinguished from one another by numbers painted on them after they are tested. The transformers are numbered in the order they come through, irrespective of size or the bank in which they are to be inserted.

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*Paper read at the Eleventh Convention of the Canadian Electrical Association, Ottawa, June 19-22.

The only difficulty to be encountered in connection with this second point happens when a new transformer is set up to reinforce the bank. When it is found from the records that a transformer in the bank is being overloaded, which really only means that the demand per unit length is becoming greater in that part of the bank, it becomes necessary to have the transformers at that point nearer one another, which means that another transformer has to be inserted, and possibly the existing ones moved. To get at the best position for this new transformer, what may be termed "trial records" are made out from the original connection slips belonging to the transformer or transformers to be relieved, by placing the new transformer and its junction boxes in different imaginary positions on the map, choosing the position which gives the best results on these "trial records." These "trial records," although very nearly correct, cannot be relied upon as absolutely accurate, and an inspection of the line has to be made after all changes are completed to determine exactly what customers have been changed from one transformer to the other, and of course records changed accordingly.

The third and possibly most important point may at first sight seem very hard to determine with any degree of accuracy, but if proper judgment be used in establishing certain factors for different classes of customers dealt with, maximum demand may easily be determined.

The factors used by the Jacques Cartier Water Power Company are governed mainly by the rate under which a consumer contracts, but in some cases also by the class of consumer to be served. For ordinary meter consumers (residences and stores of moderate size), 40 per cent. of the total installation is taken as a maximum demand; for the larger stores and manufacturers individual factors are assigned, which generally vary from 75 per cent. to 90 per cent. of total installation. For consumers on the flat rate, 90 per cent. of total capacity contracted for is taken. Consumers on limited capacity system are the most easily dealt with, as naturally the maximum demand contracted for must be taken as their maximum demand without introducing any factor whatsoever.

A few figures may be of interest to show a comparison between the actual maximum demand as read on distributing switchboard meters and the total maximum demand as estimated in the manner described above for the corresponding circuit:

Maximum demand in lamps from switchboard meters.	Estimated maximum demand.	Per cent. of actual on estimated.
1,840	2,206	83
3,200	4,272	75
1,320	1,767	75.5

As figures show that the "actual" and "estimated" bear approximately the same ratio to one another in different districts, all the more will they do so on different transformers and on the two sides of the same transformer, for the factors above referred to will actually tend to be more alike in one part of the district than in different districts. So that as far as balancing is concerned, the estimated figures may be relied upon with absolute confidence.

Another proof of at least the approximate accuracy of figures arrived at by estimate may be obtained from the fact that in spite of the very rapid growth of the plant (over 30,000 lamps of 16 cp. having been connected in about one year), and having been guided entirely by this estimated maximum demand in all changes and additions to city distribution, not one case of burnt-out transformer from overload has occurred, and only three cases of blown fuses.

It is hoped that the contents of this short paper will go towards removing some of the objections to an alternating three-wire secondary system.

Prof. Pupin's Home Ransacked.

Burglars last week entered the residence in Yonkers, N. Y., of Prof. Michael I. Pupin, of Columbia University. The police think the men were not after booty, but were searching for drawings or some clew to the electrical inventions upon which the scientist is engaged.

Prof. Pupin and his family are now in Connecticut, where he has a farm, and his Yonkers home has been closed all summer. The furnishings are all in boxes and chests, and the house is practically dismantled.

A coachman noticed that the front door of the Pupin residence stood open, but thought at first that some of the family had come to the city and had been airing the house. He watched the building for some time and then decided to investigate.

He could get no one in the building to answer his calls from the front door, and looking into the rooms, saw they were in disorder. Boxes and chests had been broken open and the contents strewn upon the floors. The coachman then notified the police.

Frederick Hackett, a brother-in-law of Prof. Pupin, was notified, and he and the police found everything in disorder. Every bureau and box, drawer and chest had been broken open, with small regard for the furniture.

The boxes and drawers had all been emptied and their contents thrown about the floors or kicked back on top of the empty boxes. Drawers, from which papers had been taken, were thoroughly searhed, and the papers, apparently after being examined, had been thrown to the floor

Silverware and other articles easily disposed of were lying around where they had been placed or thrown by the searchers of the house.

Mr. Hackett, after a careful search of the house, said to a reporter that so far as he could ascertain there was nothing missing. The police were at first inclined to believe the affair was the work of boys, but they reasoned that even boys would have taken something.

The theory that the searchers were after some of Prof. Pupin's papers or drawings was advanced by Mr. Hackett, and is now accepted as the true explanation of the affair.

Prof. Pupin has sent word that his valuable drawings and papers are safely ensconsed in safety deposit vaults.

BOOKS RECEIVED.

Shop and Road Testing of Dynamos and Motors. By Eugene C. Parham, M.E., and John C. Shedd, Ph.D. Published by "Electrical World and Engineer," New York. Bound in cloth. Price $2.50

This work, which is fully illustrated, is gotten up in as clear and concise a manner as compatible with the subject to be treated. It was the aim of the authors to provide a manual that would cover this field of work in such a way as to be a help alike to the student fresh from the theoretical side of the subject but unacquainted with shop details, and to the practical man, who is largely self-taught, as to the theory of the machines he handles. The tables in the back of the book should prove of value, especially that giving the temperature coefficients of copper wire.

Electrical Designs. Published by American Electrician Company, New York. Bound in cloth. Price $2.

This work, which contains 262 pages, sets forth clearly and concisely how to construct small motors of almost every description. It also contains instructions for testing instruments and other apparatus. This book is especially valuable, as it contains working drawings for each of the designs referred to.

American Street Railway Association.

The entertainment committee of the American Street Railway Association held a meeting recently and decided that as this was to be a three-day convention, and there were to be two business sessions on Wednesday, October 9, and on Friday, October 11, and owing to the fact that Thursday, October 10, was to be Exhibitors' Day, the committee would provide no special entertainment whatever for the gentlemen in attendance upon the convention, and would limit its effort to the entertainment of the ladies, providing such entertainment for three days. It was decided also that the committee would not give a theater party or a general reception. It was decided to open the Madison Square Garden to the public on Wednesday morning, afternoon and evening, October 9, on Thursday evening, October 10, and on Friday morning, afternoon and evening, October 11, and that a charge of 50 cents be made to the public for admission to the Garden at such times. A band will play in the Garden. It was decided that a sub committee of the general entertainment committee be appointed by the chairman, to be composed of the chairman and five members of the committee, to carry out the work laid down at this meeting, and the chairman appointed the following gentlemen: Messrs. Sanderson, McGraw, Cooke, Meneeley and Martin.

A concert will be held at the hotel on the morning of October 9, for the ladies, to be followed by a reception to the ladies. A local entertainment committeee of ladies will be appointed to hold the foregoing reception, and to act generally in the capacity of such committee. Information bureaus will be established at the hotel and Madison Square Garden. Automobiles will be provided for the general use and entertainment of the ladies attendant upon the convention for one day.

The following matters were discussed and referred to the sub-committee. Provision of carriages for the ladies' entertainment for a second day; a trolley ride over Brooklyn Bridge, and to some point of interest in Brooklyn; a large electric sign on Madison Square Garden during the continuance of the convention; an itinerary and general guide to the points of interest in and about the city of New York for free distribution; a trolley ride to Fort George; a visit to the Metropolitan Museum of Art, Riverside Drive and Central Park for the ladies.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended August 8:

Antwerp, 126 packages, $5,134; 1 case, $75; Argentine Republic, 92 packages, $2,665; Australia, 254 packages, $25,254; Belfast, 3 cases auto parts, $500; Brazil, 164 packages, $5,558, Bremen, 13 packages, $164; Bristol, 106 packages, $8,630; British East Indies, 11 cases, $2,624; British Guiana, 37 packages, $501; 1 case, $50; British Possessions in Africa, 45 packages, $4,879; British West Indies, 10 cases, $131; Central America, 12 packages, $306; China, 16 coils cable, $550; 6 packages, $330; Chili, 3 packages, $135; Cuba, 123 cases, $3,297; Glasgow, 86 cases, $3,700; Hamburg, 30 packages, $7,342; Havre, 14 cases, $524; 21 packages, $1,946; Hong Kong, 1 package, $31; 1 case, 10; Japan, 51 packages, $2,799; 74 cases, $18,429; Korea, 14 packages, $2,340; Liverpool, 60 packages, $3,071; London, 291 packages, $9,647; 22 packages motor vehicles and parts, $10,170; Manchester, 29 cases, $43,977; Marseilles, 29 cases, $662; Mexico, 391 packages, $3,309; New Castle, 46 cases, $5,310; New Zealand, 22 cases, $708; Peru, 13 cases, $410; Philippines, 17 packages, $6,345; Riga, 1 package, $83; St. Petersburg, 2 cases, $500; U. S. Colombia, 2 packages, $173; Venezuela, 313 packages, $1,632; Vienna, 1 package, $28.

The following are the exports of electrical material from the port of New York, for the week ended August 15:

Antwerp, 65 packages, $4,757; Barcelona, 70 packages, $2,145; 1 case, $27; Berlin, 2 packages, $28; Bilbao, 2 cases, $215; Bolton, 1 case, $16; British Possessions in Africa, 1 package, $13; British East Indies, 8 packages, $183; British West Indies, 52 packages, $716; Brussels, 1 package, $25; Central America, 19 packages, $69; Chili, 50 packages, $1,570; Cuba, 37 cases, $1,462; Ecuador, 1 case, $75; Glasgow, 1 case, $50; Hamburg, 55 packages, $2,024; Havre, 44 cases, $1,134; Hayti, 3 packages, $31; Leicester, 2 cases, $75; Lisbon, 2 cases, $188; Liverpool, 132 packages, $11,504; 1 package auto parts, $150; London, 80 packages, $3.070; 44 cases, $742; Manchester, 6 packages, $410; Mexico, 30 packages, $1,499; Milan, 17 packages, $350; New Castle, 11 cases, $1,500; Nova Scotia, 9 packages, $31; Peru, 31 packages, $684; Santo Domingo, 11 packages, $122; U. S. Colombia, 16 packages, $282.

Many Orders for the Sprague Company.

The Sprague Electric Company is receiving many orders for its apparatus from all parts of the country and abroad. Among a few recent orders are the following: 90 kw. split-pole generator shipped to Bailey, Walker & Co., Buenos Ayres, S. A.; 125 kw. split-pole generator, Steelton Light, Heat & Power Co., Steelton, Pa.; 37½ kw. split-pole generator. Ft. Wadsworth, Staten Island; 37½ kw. engine type generator, Ft. Hancock, N. J.; 80 hp. motor, American Linseed Co., Staten Island; 100 kw. engine type split-pole generator, Geuder & Paeschke Mfg. Co., Milwaukee; 50 kw. generator and 15 hp. motor, Roe & Conover, Newark, N. J.; 85 hp. motor, John Stephenson Co., Elizabeth, N. J.; 75 kw. split-pole generator, Chase Rolling Mill Co., Waterbury, Conn.; 75 kw. split-pole generator, Fred Miller Brewing Co., Milwaukee; 100 kw. 550 volt split-pole belted type generator, Plymouth Mills, Plymouth, Mass.; 100 kw. belted type split-pole generator, C. S. Ashley, Toledo, O.; 100 kw. 550 volt, belted type split-pole generator, and various motors up to 50 hp., T. C. Keller, Chicago; a quantity of motors for the mines and refining plant of the Arlington Copper Co., Arlington, N. J.; 100 hp. motor, American Locomotive Co., Cooke Works, Paterson, N. J.; 60 kw. split-pole generator, Fahy's Watch Case Co., Sag Harbor, L.I.; 2 25-kw. engine type split-pole generators for Madison Square Garden, New York, and 100 kw. split-pole engine type generator, Leland Hotel, Chicago.

The Stromberg Carlson Catalogue.

We are in receipt of a handsomely gotten up catalogue, issued by the Stromberg-Carlson Telephone Manufacturing Company, 70-82 West Jackson Boulevard, Chicago, Ill. The catalogue, which is profusely illustrated, contains sixty-four pages of matter descriptive of the "Central Energy System," portable desk and combination telephones, hotel telephones, switchboards, heat wire lightning arresters, magnetos, generators and extension bells—in fact everything of interest to a telephone company.

COMING ELECTRICAL EVENTS

American Institute of Electrical Engineers—General Meeting, Buffalo, N. Y., August 20-24.

American Street Railway Association—Convention, New York City, October 9, 10 and 11.

American Electro-Therapeutic Association—Buffalo, N. Y., September 24, 25 and 26.

Association of the Edison Illuminating Companies—Meeting, September 10.

International Association of Municipal Electricians—Convention, Niagara Falls, September 2, 3 and 4.

Ohio Electric Light Association—Convention, Put-in-Bay, August 20, 21 and 22.

Old-Time Telegraphers' Association and U. S. Military Telegraph Corps—Convention, Montreal, September 11, 12 and 13.

Pennsylvania State Street Railway Association—Convention, York, Pa., September 4.

Roentgen Society of the United States—Meeting, Buffalo, N. Y., September 10 and 11.

INCORPORATIONS.

The Chickasha Electric Company, Winsboro, Tex. Capital stock, $30,000. Incorporators: L. S. Schluter, W. T. Whiteman and E. M. Decker.

The Harrison Electric Light & Ice Company, Harrison, Mo. Capital stock, $25,000. Incorporators: N. W. Fellows, Springfield, Mo., president; N. C. Hines and R. M. Fellows, of Harrison.

The Citizens' Light, Heat, Power & Ice Company, Bowling Green, O.—to manufacture, generate, transmit and sell electricity. Capital stock, $125,000. Incorporators: G. L. Long, Jacob Henne, Joseph Shauerer, Walter McCullough and E. H. McKnight.

The W. F. Irish Electric Company, New York City. Capital stock, $15,000. Directors: T. M. Belknap, F. M. Clute and C. R. La Rue, all of New York City.

The P. I. Fajans Electrical Construction Company, New York City. Capital stock, $5,000. Directors: Isidor Fajans, New York; George F. Cook, Matteawan, and Martin S. Kattenhorn, Keyport, N. J.

The Oakland Electrical Company, Oakland, Cal.—to purchase and manufacture all kinds of electrical goods and the building and repairing, etc., of vessels and other structures. Capital stock, $25,000. Directors: J. O. Larrabee, James W. Cox, Charles F. Reuter, Howard L. Osgood and Frank N. Brooks.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUGUST 13, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

680,212. Car-Fender. Nathan Abrahams, St. Louis, Mo. Filed April 9, 1901.

680,286. Trolley Guard. Charles E. Stanley, Canton, O. Filed March 20, 1901.

680,317. Electric Brake-Release. Edwin E. Darling, Anaconda, Mont. Filed Sept. 27, 1900.

680,336. Electric Switch. George E. Linton, Worcester, Mass. Filed Sept. 14, 1900.

680,437. Trolley-Stand. Eugene J. Parker, Worcester, Mass., assignor to himself, and Alexander S. Paton, Leominster, Mass. Filed Jan. 31, 1901.

680,567. Trolley-Wheel. William C. Cottrell, Asbury Park, N. J., assignor of one-half to Houston Fields, Freehold, N. J. Filed Nov. 22, 1900.

680,623. Electrical Switch-Operating Mechanism. Clifton B. Russell, Marlboro, Mass., assignor of one-half to Herbert E. Ryder, same place. Filed May 3, 1901.

680,662. Trolley-Stand. Edward J. Kelley, Baltimore, Md., assignor to G. Fred Johnson, Norfolk, Va. Filed Dec. 14, 1900.

680,653. Trolley Stand. Edward J. Kelley, Norfolk, Va. Filed May 18, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

680,242. Incandescent Electric Lamp. Howard Gilmore, Boston, Mass. Filed June 14, 1899.

680,636. Device for Lighting Lamps by Electricity. Henry M. Brigham and Svend M. Meyer, New York City. Original application filed Feb. 5, 1898. Divided and this application filed Oct. 26, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

680,234. Electrical Coulomb-Meter. Samuel E. Doane, Marlboro, Mass. Filed Dec. 10, 1900.

680,236. Regulation of Dynamo-Electric Machines. Harold Edwards, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed May 17, 1901.

680,316. Timed Electric Switch for Multiple Rate Meter Systems. Frederick R. M. Cutcheon, St. Paul, Minn. Filed March 29, 1901.

680,421. Transformer. Frederick C. Sutter, Pittsburg, Pa., and Robert V. Bingay, Montreal, Canada. Filed May 23, 1901.

680,597. Dynamo-Electric Machine and Electric Motor. Henry F. Joel, London, Eng. Filed May 21, 1901.

680,619. Electric Traction Motor. Charles Richter and Richard T. Eschler, Camden, N. J. Filed Jan. 15, 1901.

680,652. Circuit-Breaker. Leonard J. Elden, Boston, Mass. Filed Nov. 8, 1897.

MISCELLANEOUS.

680,254. Electrical Conduit and Box. Hebert Krantz, Brooklyn, N. Y. Filed May 3, 1901.

680,252. Thermo-Electric Regulator for Valves or Dampers. William E. Mack, Oswego, N. Y. Filed July 21, 1900.

680,265. Current-Collecting Device. Walter S. Moody, Schenectady, N. Y., assignor to General Electric Company of New York. Filed May 22, 1901.

680,277. Electrical Conductor. Edward D. Priest, Schenectady, N. Y., assignor to General Electric Company of New York. Filed May 31, 1901.

680,307. Motor-Vehicle. George B. Anderson, Washington, D. C. Filed Oct. 29, 1900.

680,339. Graphophone. Thomas H. Macdonald, Bridgeport, Conn., assignor to the American Graphophone Company of West Virginia. Filed No. 22, 1897.

680,408. Apparatus for use in Electrodeposition of Metals. Shepard O. Cowper-Coles, Westminster, England. Filed April 8, 1901.

680,423. Temperature-Regulating Apparatus. Henry Winkenwerder, Milwaukee, Wis., assignor to Johnson Electric Service Company, same place. Filed Aug. 18, 1898.

680,431. Diaphragm Tube-Plate for Phonographs. William R. Dutemple, Auburn, R. I. Filed Oct. 12, 1900.

680,440. Electrolytic Apparatus. Brodde E. F. Rhodin, Sault Ste. Marie, Canada, assignor to American Alkali Company, Camden, N. J. Filed July 19, 1900.

680,441. Electrode for Electrolytic Cells. Brodde E. F. Rhodin, Sault Ste. Marie, Canada, assignor to American Alkali Company, Camden, N. J. Filed July 19, 1900.

680,505. Autotorpedo. Harry Shoemaker, Philadelphia, Pa., assignor to Gustave P. Gehring and Marie V. Gehring, same place. Filed Feb. 1, 1901.

680,520. Process of Making Metallic Duplicate Phonograph-Records. Thomas A. Edison, Llewellyn Park, N. J. Filed Aug. 18, 1900.

680,532. Secondary Electric Clock. Fidelis Luckin, Detroit City, Minn. Filed Feb. 8, 1901.

680,535. Apparatus for Charging Storage Batteries of Automobile Vehicles. Joseph B. Meriam, Cleveland, O. Filed Oct. 11, 1900.

680,590. Electrical Signaling Apparatus. Felix B. Herzog and Schuyler S. Wheeler, New York City; said Wheeler assignor to said Herzog. Filed Jan. 25, 1886.

680,614. Photophonograph-Photophone or Similar Device. Joseph Poliakoff, Charlottenburg, Germany. Filed July 17, 1900.

680,618. Electric Automobile-Motor. Charles Richter and Richard T. Eschler, Camden, N. J. Filed Jan. 15, 1901.

680,629. Electric Belt. James Trussel, Chicago, Ill., assignor of one half to John H. Courll, same place. Filed Dec. 8, 1900.

680,668. Automobile Vehicle. Alden E. Osborn, New York City. Filed Sept. 6, 1900.

THE TELEPHONE WORLD.

Independent Telephone Companies to Combine in Pennsylvania.

The independent telephone companies of Pennsylvania are to form a consolidated company for the purpose of bettering the service and competing with the old companies.

The Lackawanna Telephone Company of Scranton will hold a meeting on September 24, for the purpose of approving or disapproving of the consolidation scheme. The stockholders of the local company will probably approve of it, and the Lackawanna will become part of the Consolidated Telephone Company of Pennsylvania.

Robert E. Wright, of Allentown, the traction magnate, is president of the Consolidated Company and Manager Niland, of the Lackawanna Company, will probably be made general manager.

Recently an agreement was arrived at by the representatives of the independent companies operating in the cities of Scranton, Carbondale, Wilkes-Barre, Hazleton, Reading, Allentown, Easton and Bethlehem, by which they are to be conducted as one company for the purpose of improving the service of all the companies and as a measure to prevent the wiping out of any of the independent companies. The Inter-State Long Distance Telephone Company will be operated in connection with the Consolidated Company for long-distance purposes.

Covington, Ga., will soon have a new local telephone system incorporated under the name of the Covington Telephone Company. Work is being rapidly pushed on the new line and it will be completed and ready for service by September 1. The new company was organized several weeks ago by the business men of Covington, the new organization growing out of dissatisfaction with the rates, etc, of the Southern Bell's local exchange. The new company is a stock company with a capital of $1.800 Most of the subscribers are stockholders, each subscriber having a $25 share of stock. When the system is completed the object of the company will be to make expenses and declare only a small dividend, as each subscriber is a stockholder and will get full benefit of the reduction in rates. The rates of the new company will not exceed $1.50 per month for business 'phones and $1 per month for residence phones; whereas the Southern Bell Company has been charging $3 50 per month for business 'phones and $1.50 for residence. The success of the new company is almost assured, as it meets with the hearty co-operation of all the business men, and they are giving it their best support. C. C. Brooks is president of the company.

A company of men from Warren, Youngstown and Cleveland, O., have formed a stock company, and have closed an option on the plant and system of the Columbia Telephone Company at Portland, Ore. This is one of the largest and best independent systems on the Pacific coast, the purchase price being $160,000. It is the intention of the owners to consolidate the Portland system with that of the Automatic Telephone Company of Seattle, Wash., which they also own. The company will connect up the two cities with long-distance service, and will incorporate as a stock company with a capital stock of $1,000,000. Attorney Charles Fillius, of Warren, O., has been in Portland, closing up the deal.

A report from Yorktown, Va., states that the stockholders of the Chesapeake Telephone & Telegraph Company held their annual meeting a short time ago, and elected these officers: President, E. E. Slaight; vice-president, George L. Smith; treasurer, T. P. Hudgins; secretary, J. E. Crockett; directors: Prof. H. S. Bird, E. W. Wombleton, J. W. Clems, S. R. Curtis, E. T. Leach, J. Crockett and George F. Smith. A resolution was passed cancelling certain actions of the board at its previous meetings It is thought this has connection with the proposed consolidation of the telephone lines on the Peninsula.

The towns of Frenchtown, Baptisttown and Locktown, N. J., have been connected by telephone. The line will be built to Sergeantsville and Flemington, where connections will probably be made with the local telephone wires connecting the outlying towns to Flemington.

A short time ago the directors of the Southern Telephone Company met in Paris, Tex., and elected Jasper N. Yeager, of Lake Creek, Delta County, manager in place of W. L. Miller, resigned. It was decided to put in a central office and establish a local exchange in Paris.

The telephone exchange at Lime Spring, Ia., was destroyed by fire last week.

The new long-distance telephone line has been finished between Richmond and Petersburg, Va.

Indians to Use Telephones.

A ten-mile telephone line and a modern telephone system for local use in a northern town in British Columbia is the latest step towards civilization that the twentieth century Indians of Kishpieaxe village on the Skeena River are arranging, says the Vancouver "Province." The telephone wires and accoutrements were taken north by the steamer Tees, and the system will be installed under the care of the Rev. Mr. Pearce, the Methodist missionary. In a very short time it will be possible for the Indians at the end of the telegraph line at Hazleton to telephone to their brothers in the village 10 miles further on. Kishpieaxe is by far the largest village in that vicinity, having a population of over 600. It has always been noted for the intelligence of its Indians, and the district in the immediate vicinity is a good one. Lately the telegraph line has been strung from Port Simpson and Port Essington on the coast up to Hazleton. The Indians appreciate this good work on the part of the Federal Government, but have decided to help themselves still further. When messages are sent by telegraph to Hazleton, they may be repeated over the telephone to the main village.

Telephonic Secrecy.

An attachment is provided in Sweden by which the secrecy of the telephone line is assured. The apparatus, which is rented at a moderate rate, indicates whether or not the telephone operator is listening to the conversation.

It is understood that the Albany New Telephone Company will soon begin business in Cohoes, N. Y. This company is the one which the new Cohoes company is a part. The franchise for erecting poles, stringing wires and maintaining a system in Cohoes belongs to a company represented by John Clute and Hugh Graham. The New Company will give house service for $18 a month and business r $80 a month.

The East Tennessee Telephone Company is gradually adding to its toll line service in Knoxville territory. Arrangments will soon be made to extend the toll lines into Kentucky territory. A new branch line has recently been erected to Lea Springs and Blaine, and connection made from Knoxville to those two points.

The gold belt line of the Rocky Mountain Bell Telephone Company was opened to Hailey, Idaho, recently. Two miles of old line was utilized in making the connection, but this will be replaced by the regular copper wire of the system. This line is 123 miles in length, and runs by way of Mountainhome. Its construction was begun late last fall.

The telephone company opened the station at Opal, Wyo., a short time ago, thus giving connection with the Big Piney country and the towns to the north of Unita County, Wyo. The company will build a connection between Tintic and Nephi, Utah, which will relieve the lines between Tintic and Salt Lake.

The Governor of Mississippi has approved the charter of the Yazoo Valley Telephone & Telegraph Company at Greenwood. The capital is $150,000. Harvey Myers, W. D. Crist, F. C. Smith, C. E. Wright. W. T. Rush and J. F. Gardner are the incorporators.

Papers under which the Huron County Telephone Company and the New Washington Telephone Company are consolidated were recently filed. The capital stock is $60,000 and the principal place of business Bellevue, O.

J. J. Weaver, Joseph Voltz and John Burnett, of Ludlow, O., have formed a company for the manufacture of phonographs and telephones.

The Sibley County telephone line has been extended to Le Seur, Minn. It will be run in connection with the Le Seur Telephone Company. H. F. Weis is manager.

A telephone line is being constructed from Jewett to Oletha, Tex., some 20 miles west of Jewett, where it will connect with the line already built from there to Groesbeeck.

The W. P. Veitsch Telephone Company of Galesville, Wis., was sold out to the Arcadia Telephone Company for $4,000.

Bell & Murray, of Saline, Kan., have a full force at work on a telephone system at Harper, Kan., and will shortly have the line in operation.

The Diamond State Telephone Company has completed its line in Delaware City, Del.

No Rival Now for Pacific States Telephone Company.

The Pacific States Telephone Company absorbed the Spokane and British Columbia Telephone & Telegraph Company August 14. This leaves no rival in the Inland Empire, and the territory covered will include all the coast States besides British Columbia, Idaho and Montana.

S. M. Balaboock, manager of the Spokane & British Columbia Company, verified the statement recently.

It is understood that the purchaser held a mortgage on the company absorbed amounting to $15,000, and that with the taking over of this mortgage and a large cash payment the deal was effected.

The cash payment could not be ascertained. The deal originated in the San Francisco office of the Pacific States Company.

The controlling interest of the Citizens' Standard Telephone Company of Kingston, N. Y., has passed to the American Construction & Trading Company of Elyria, O. The deal was consummated last week, when a check for $50,000, the purchase price, was handed to the officers of the old company. It is purposed to improve the telephone system and to extend it. Many thousand dollars will be expended in this work.

According to news received from Tacoma, Wash., E. A. Seeley has filed with the city clerk a formal acceptance of the franchise granted last month for the construction, operation and maintenance of a second telephone system in that city. The franchise also provides for a cash deposit of $5 000 as evidence of good faith. It is stated that this sum will be deposited in the near future.

The first stockholders' meeting of the People's Telephone Company was held at Jackson, Mich., this month, and a board of directors chosen, as follows: J. C. Richardson, Z. C. Eldred, G. W. Carter, G. A. Matthews, W. H. Maloney, M. F. Cottrell and T. M. Smith, of Jackson; Arthur Pack, of Orchard Lake, and Jos. B. Ware, of Detroit.

The telephone line being constructed by the American Telephone Company between Rome and Chattanooga has reached Lafayette, Ga. This will prove quite an advantage to the town, putting it in easy communication with the outside world.

S. C. Platt, the representative of the Kellogg Company of Chicago, independent manufacturers of telephone apparatus has been in Richmond, Va., and closed a $50,000 contract, with the Richmond Telephone Company for a new switchboard and telephones throughout.

The telephone line of Fugazzi, Brownlee & Co., has been completed and is in working order from Adairsville to Plainville, Ga., through the fruit district. It is seven miles long. There is some talk of extending the line to Calhoun from Plainville.

The Southern New England Telephone Company will branch out into Chesterfield, Conn., and the vicinity, a new territory where telephone connection will be greatly appreciated.

The ordinance granting the Springfield, O., Home Telephone Company a franchise through the streets of that city was lately placed upon its third reading at the regular meeting of city council and passed.

The New England Telephone Company is extending its line from East Sheldon to Herrick, Vt.

TELEPHONE INCORPORATIONS.

The Luke T. Walker Telephone & Telegraph Company Davidson County, Nashville, Tenn. Capital stock, $10,000 Incorporators: Luke T. Walker, J. W. Scott, E. T. Peck, W. M. Brandon and T. J. Brandon.

The Maxwell & Brady Telophone Company, Brady Island, Neb. Capital stock, $2,000. Incorporators; W. H. Plummer, G. R. Swancott, W. S. Cowgill, J. H. Giffen, E. D. Murphy, C. H. Kuhns, Reed Dolan and R. C. Burke.

The Cohoes-Waterford Home Telephone Company, Cohoes, N. Y.—to operate in Albany and Saratoga Counties. Capital stock. $200,000. Directors: S. B. Rawson, F. H. Sudro and I. H. Griswold, Elyria, O.

The Electric Exchange Telephone Company, Schenectady, N. Y. Capital stock, $10,000. Directors, Charles F. Vedder, Alexander M. Vedder, Charles A. Palmer, R. T. Lomasney and G. M. Bostwick, Schenectady; T. P. Farrett, Ballston; W. Barlow Dunlap, Amsterdam.

GENERAL ELECTRICAL NEWS.

Lighting.

Baltimore, Md.—It is stated that the Baltimore & Ohio Railroad will establish an electric lighting plant at Sand Patch to light up the tunnel.

Boonsboro, Md.—The electric light plant here was lately destroyed by fire.

Boonville, N. Y.—G. O. Bridgman and the board of trustees have begun in earnest to investigate the feasibility of this village owning its electric light plant.

Braddock, Pa.—The Keystone Electric Company has been formed here with a capital stock of $100,000, and will build a plant to compete with the Monongahela Light & Power Company. The leaders in the movement are Judge F. T. Redman, Harvey McKinney and James P. Purcell.

Bristol, Conn.—C. W. Eaton is at the head of a scheme to cheapen the cost of electricity to consumers about Bristol. The promoters claim that they can furnish electricity to those who want it for lighting and other purposes for about half the present cost.

Greenwood, Tenn.—The city council lately granted C. E. Wright of this city a twenty-five year franchise for the construction of a complete waterworks, sewerage and electric light system.

Iron Mountain, Mich.—A deal is about to be closed here whereby A. R. Goodman, of Marinette, Wis., and Chas. Goodman of New York City, representing a company of capitalists, will get control of the water power in Pine Creek, two miles west of this city. An electric light and power plant will be erected there.

Jeannette, Pa.—The People's Light & Power Company of this place was formed lately, with considerable money back of it, and it is said the plans of the Allegheny and Westmoreland concern will be carried out by the new company.

Lincoln, Ill.—It is stated that this city is much in need of a good electric light system.

Marshall, Mich.—At the recent council meeting it was voted to hold an election August 29 to bond the city for $63,000 to make improvements on the municipal electric light and waterworks plant.

Mascoutah, Ill.—This city is about to make a new contract for electric street lighting. Bids are wanted September 16.

Merrilon, Wis.—By a vote of 108 to 35 the citizens decided to bond the village for $10,000 to build an electric light plant and a system of waterworks.

Monterey, Cal.—The electric light company of this place will extend its lines to Pacific Grove and New Monterey on one side and Oak Grove on the other side of Monterey.

Orange, N. J.—It is probable that the common council of this city will sign a five-year contract for lighting the streets of Orange with the National Electric Company, a new-comer in the field of electric lighting, the National Company having underbid its competitor, the United Electric Company, which has had the contract for many years, by $15 per lamp.

Racine, Wis.—This place is to have an electrically-lighted drinking fountain to cost about $1,000.

Renton, Wash.—Preparations are under way for the installation of an electric lighting system at the Seattle Electric Company's mines.

Salem, Pa.—An electric plant will be installed at the Salem Glass Works along with the other improvements to be made before the resumption of work in the fall.

St. Anthony, Idaho. J. T. Sidney and Levi Carter have been granted a franchise for 20 years to operate a waterworks and electric light system here.

Wautoma, Wis.—The prospects are that this village will have an electric lighting plant.

Washington, D. C.—Plans for an electric light and steam heating plant for the Fort Totten, N. D., Indian School, have been completed at the Indian office and the contract will be put on the market shortly. Senator Hansborough secured an appropriation of $18,000 for the purpose last winter.—Sealed proposals will be received at the United States Engineer's Office, 735 North Capitol Street, this city, until noon, September 9, and then publicly opened, for furnishing distributing centers for electric lighting and power circuits for new building for Government Printing Office. Information furnished on application to John Stephen Sewell, Captain Engineers.

Windfall, Ind.—The town trustees have approved the estimates for waterworks and an electric light plant and will call for bids.

Street Railways.

Albany, N. Y.—The Hudson Valley Electric Railway Company was incorporated last week with a capital of $2,600,000. It is a consolidation of the electric railway systems from Troy to Lake George. The officers of the company are: Addison B. Colvin, president; Senator George Green, vice-president; Thomas O'Connor, secretary, and F. L. Cowles, treasurer.

Anniston, Ala.—An effort is now being made by the citizens of this place, Gadsden and Attalla to have an extension built on the line of the Louisville & Nashville Railroad that will run into the rich ore and coal region of Blount County.

Danville, Ill.—Members of the Covington Traction Company, who propose to build an interurban railroad connecting Covington, Attila and Danville, were here recently looking over the ground.

Jersey City, N. J.—The American Elevated Railroad Company has been incorporated in New Jersey with a capital of $5,000,000. Osborn Congleton, president of the company, says: "Our system uses small electric motors."

Johnstown, N. Y.—From this city to Saratoga by electric cars is among the probabilities of the near future, even if the Ballston terminal road should not be built, as the Schenectady Railway Company has made an agreement with the Saratoga Traction Company for a through electric railroad line to be built between the two places.

Kansas City, Kan.—An electric line from this city to Olathe, a distance of about 25 miles, is now one of the probabilities of the future.

Milwaukee, Wis.—It is reported that the Milwaukee Electric Railway & Light Company will ask for a change in its franchise so as to carry freight.

New Brunswick, N. J.—The Raritan Traction Company has been granted a franchise to construct a trolley line in the borough of Metuchen, where this line is completed to Perth Amboy.

Norwalk, O.—The city council has granted a franchise to the Norwalk, Ashland & Southern Electric Line.

Ottawa, Ill.—The Illinois River Railway Company, capitalized at $150,000, to operate an electric railway in La Salle and adjoining counties, has been incorporated by Lewis W. Hess, Jacob I. Warner and Henry A. Sherman.

Red Bud, Ill.—The proposed electric line from East St. Louis to Chester, passing through Millstadt, Columbia, Waterloo, the Mammoth Cave grounds and this place is now a certainty.

Wabash, Ind.—Noble township, which includes this city, has voted $50,000 in aid of the proposed Wabash & Rochester Electric Railway.

Wallington, N. Y.—New York capitalists are considering the project of building an electric railway from here to Baldwinsville, and they believe that arrangements could easily be perfected for running over the Lakeside Railway from Baldwinsville into Syracuse.

Company Matters.

Greenwich, N. Y.—The Consolidated Electric Company of this place has increased its capital stock from $50,000 to $75,000.

La Crosse. Wis.—Three large lighting companies of this city, the La Crosse Edison Light Company, capital stock, $100,000; the La Crosse Gas Light Company, capital stock, $150,000; the Brush Electric Light & Power Company, capital stock, $80,000, were lately sold to Chicago capitalists. The companies will all be under one management. The new owners will continue business with an increased capital stock of $500,000.

Washington, Pa.—The offices of the Washington Carbon Company have been removed to this city.

Manufacturing.

East Orange, N. J.—The Sterling Electrical Motor Company had its articles of incorporation filed with the county clerk recently. The articles state that the concern will manufacture and deal in dynamos, electric motors and deal in other electrical appliances and plants. The capital stock is $30,000, with $1,000 paid up. The incorporators are James R. Maplpetroff, Frank C. Ferguson and H. M. Smith. Its principal office is the New Jersey Registration & Trust Company, 525 Main street, East Orange.

New York City.—The Van Degrift Equipment Company has been formed to manufacture power transmission appliances with a capital stock of $1,000. F. H. Smith and R. F. Manning, of this city, and F. S. Gemmell of Jersey City, are the directors.

Troy, N. Y.—The Standard Signal Company of this city, with a capital of $300,000, was incorporated recently. The company proposes to manufacture and install mechanical, electrical, pneumatic or other systems of interlocking block signals and safety appliances for railroads of every description. The company's principal office is located in Troy, but its operations will extend throughout the United States and foreign countries. The directors are Alfred H. Renshaw and Palmer C. Rickett, of Troy, Henry Burden, Jr., of Cazenovia, John T. Cade of Ridgefield, N. J., and Harvey N. Loomis, of New York. Mr. Cade holds the controlling interest.

Power and Transmission.

Buchanan, Mich.—About $100,000 will be spent in improving the water-power here and putting in electric generators and 11 turbine wheels.

Cheyenne, Wyo.—The Boston-Wyoming Smelter Company will at once put in an electric power and lighting plant at the mill. The power will also be used in lighting the town of Grand Encampment. The electric equipment of the mill will include machinery for the reduction of the copper matte to copper pig of 98 per cent. bullion.

San Jose, Cal.—R. G. Hanford, promoter of the plan to organize the electric roads of this, San Mateo and San Francisco Counties under one management, has filed three notices of intention to use certain water rights of the Mount Hamilton water-shed for the purpose of generating electric power. The power plant, according to the notices, will be located in the Calaveras valley. The water rights covered are on Smith Creek, Bonita Creek and the Santa Isabel.

Automobiles.

Chicago.—An electric automobile omnibus is now run from Rush street and Bellevue place to Diversey avenue, the route lying through Lincoln Park and north shore thoroughfares. Forty-nine similar motor omnibuses are in course of construction and will be put into boulevard service when completed.

Cleveland, O.—The Cleveland Motor Carriage Company was recently incorporated with $10,000 capital stock.

Elgin, Ill.—This city is to have an automobile factory.

Mansfield, O.—President Warren S. Weiant, of the Newark Auto Coach Company, has announced that the two coaches, which are being built here, will be ready for operation soon. Each coach will seat from 12 to 18 people. The contract for the automobile coaches is held by the Beardsley & Gibbs Automobile Company of this city.

New York City.—Deputy Sheriff Strauss recently sold out the property of the Auto Electric Company of No. 61 Elm street, under an execution of $8,940, and the sale realized about $4,000.

Wilmington, Del.—A corporation to do business in this city with automobiles is a promised institution. Capt. Horace Wilson, manager of the Wilmington Steamboat Company, is the head of the new concern. Negotiations with several manufacturers of the horseless vehicles are under way.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Albany, N. Y.— Aug 19						
United Traction..........	100	$5,000,000	$5,000,000	1½ % Q.,	105	107
(Consolidation of the Albany and Troy City Railway.)						
Allentown Pa.— Aug 19						
Allentown & Lehigh Val. Trac. Co		4,000,000	1,500,000	....	--	15
Bridgeport, Conn— Aug 19:						
Bridgeport Traction Co...........	100	2,000,000	2,000,000	1 % Aug.,	100	...
Baltimore Md— Aug 19						
a United Railways & Elec. Co...com	50	24,000,000	18,000,000	....	16⅜	16¾
Boston, Mass.— Aug 19						
New England Street Ry............	25	5,000,000	1,081,925	1 % Q., Jan.15,	...	..
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	15	16
North Shore Traction Co........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	85	87
b West End Street Ry. Co......com.	50	10,000,000	[illegible]	8½ % S., Oct.,	96	96¼
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Jan.	110	110⅛
Boston Elevated R. R..............	100	10,000,000		2¼ % Aug. 99,	186	187
Brooklyn N. Y.— Aug 19						
Brooklyn City Ry..................	100	2,000,000	1,928,400	....	242	244
Brooklyn Rap. Transit Co., tr certif..	100	48,000,000	48,000,000	....	74⅛	74½
cBrooklyn Heights Railroad......	....	200,000	200,000	....	107	109
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	8¾ % Q., Jan.,	287	289
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR.......	100	2,000,000	1,884,200	2½ % Nov.,	325	330
Kings County Elevated.............	....	4,750,000	4,750,000	....	--	...
Kings County Traction Co..........	100	4,500,000	4,500,000	1 % July	..	..
Nassau Electric Railroad ....pfd.	......	6,000,000	6,000,000	....	82	85
fAtlantic Avenue Railroad........	50	2,000,000	2,000,000	....	--	--
gBrooklyn, B. & W. E. Railroad..	....	1,000,000	1,000,000	....	--	--
Buffalo N. Y.— Aug 19						
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	....	74	75
*Buffalo Railway Co................	100	6,000,000	5,870,500	1 % Q. Dec.	91	92
Columbus O.— Aug 19						
Columbus Street Railroad..........	100	8,000,000	8,000,000	1 % Q., Feb.	45	47
Columbus Street Railroad, pfd....	100	1,500,000	1,500,000	....	102	105
Charleston, S. C.— Aug 19						
Charleston City Ry. Co.............	50	100,000	100,000	8 % S.	--	--
Enterprise City RR. Co.............	25	1,000,000	250,000	....	--	--
Chicago, Ill.— Aug 19						
Chicago City Ry. Co................	100	12,000,000	12,000,000	8 % Q., Dec. 81,	202	203
Chicago & South Side R. T. RR....	100	10,828,800	10,828,800	....	..	..
Lake Street Elevated RR...........	100	10,000,000	10,000,000	.....	12¾	13
Metropolitan West Side Elev. Ry...	100	15,000,000	7,000,000	Feb 28 1900.	36	36½
Met. West Side El., pfd.............	100	15,000,000	9,000,000	....	9 ½	36
North Chicago Street RR............	100	10,000,000	6,600,000	8 % Q., Jan.	209	210
hNorth Chicago City RR............	100	500,000	249,900	....	200	202
South Chicago City Railway........	100	2,000,000	1,608,200	....	108	109
West Chicago St. RR. Co............	100	20,000,000	18,189,000	1½ % Q., Feb.	100	100½
Union Traction Ry..............com	....	1,250,000	624,900	85 %	15	16
Union Traction Co. ....pref	100	2,000,000	2,000,000	5 % S.	58	59
Cincinnati, Ohio.— Aug 19						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	--	--
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	½ % Feb.	--	--
Cincinnati, Newport & Cov. St. Ry.	100	3,000,000	3,500,000	2½ % Feb.	75	76
lCincinnati Street Ry. Co...........	50	18,000,000	14,000,000	1¼ % Q., Jan.	124½	125
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1½ % Q., Jan.	126½	127
Cleveland, Ohio— Aug 19						
Akron, Bed. & Clev. Elec. Ry.......	100	1,000,000	1,000,000	¾ % Jan.	48	50
Cleveland City Ry...................	100	8,000,000	7,600,000	⅝ % Jan.	102	103
Cleveland Electric Ry...............	100	12,000,000	12,000,000	¾ % Q., Oct.,	83½	85½
Detroit, Mich.— Aug 19						
Detroit Citizens' Street Ry..........	100	2,000,000	1,250,000	....	100½	--
Ft. Wayne & Belle Isle Ry..........	100	....	1,200,000	....	175	..
Rapid Railway Co...................	....	250,000	250,000	....	90	100
Detroit Electric Railway............	...	1,000,000	1,000,000	....	...	75
Wyandotte & Detroit River Ry.....	100	250,000	200,000	....	100	11[illegible]
Dayton O.— Aug 19						
City Railway Co............... com.	100	1,500,000	1,470,600	1¼ % Q.	140	145
City Railway Co............... pfd.	100	600,000	600,000	1½ % Q.	170	..
People's Street Railway........		1,100,000	1,100,000	....	114	115

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Hartford Conn—Aug						
Hartford Street Ry. Co..............	100	$4,000,000	$200,000	8 % S., Oct.,	150	-
Hartford & West Hartford	100	1,000,000	247,000	------ ------		-
Holyoke Mass.—Aug 19						
Holyoke Street Ry. Co.............	100	400,000	400,000	8 % A., June,	207[illegible]	212
Hoboken N. J.—Aug 19						
North Hudson Co. (N. J.) Ry. Co...	25	1,250,000	1,000,000	8 %,	150	
Indianapolis, Ind—Aug 19						
**Indianapolis Street Ry..........	....	5,000,000	5,000,000	------ ------	25	25½
Lancaster, Pa.—Aug 19						
Pennsylvania Traction Co..........	100	10,000,000	9,900,000	....	--	..
Lancaster & Col. Electric Ry......	....	....	87,500	....	--	...
West End Street Railway.........	....	....	....	....	--	..
Louisville, Ky.—Aug 19:						
Louisville Ry....................com.	100	4,000,000	3,500,000	1¼ %., April.	82	83
Louisville Ry.......................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1,	112	113
Minneapolis, Minn.—Aug 19						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	89	89¼
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,712,200	1¾ %. Oct.	186	187
Montreal, Canada.—Aug 19						
Montreal Street Ry. Co..............	50	4,000,000	4,000,000	8 % S., M. & N.	290	291
Toronto Street Ry. Co..............	100	6,000,000	6,000,000	1¾ % S., J. & J.	109¾	109⅞
Memphis Tenn.— Aug 19						
Memphis Street Railway Co.........	100	500,000	500,000	....	[illegible]	-
New Haven, Conn.—Aug 19						
Fair Haven & Westville RR.........	25	2,000,000	2,000,000	8 % S., Sept.	39	41
New Haven Street Railway Co......	100	1,250,000	1,000,000	2½ % A., July	...	..
New Haven & Centerville..........	100	700,000	800,000	....	..	
Winchester Avenue RR.............	25	1,000,000	600,000	....	45	46
New Orleans, La.—Aug 1						
Canal & Claiborne RR. Co..........	40	240,000	240,000	4 % S., July,	..	..
New Orleans & Carrollton RR......	100	1,200,000	1,200,000	1½ % Q., Oct.	148½	158
New Orleans Traction Co new com.	100	....	....	....	26	28
New Orleans Traction Co new pfd.	100	....	....	....	102	103
aCrescent City RR............guar.	100	2,000,000	2,000,000	8 % S., Jan.,	40½	..
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan.,	..	..
Orleans Railroad....................	50	500,000	185,000	1½ %., June,	..	52
St. Charles Street Railway..........	50	1,000,000	1,000,000	1¼ %. Oct.,	56½	57
New York—Aug 19						
Central Crosstown RR...............	100	600,000	600,000	2½ % Q.	255	260
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Oct.,	175	185
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Nov.	120	125
dMetropolitan Street Ry. Co........	100	45,000,000	45,000,000	2½ % Q., Feb., 1901	166	166¼
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July,	3[illegible]	36
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	241	249
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1 [illegible]0,000	2¼ % Q.	205	2[illegible]0
hEighth Avenue RR................	100	1,000,000	1,[illegible]0,000	....	400	410
i42d St. & Grand St. Ferry RR. guar	100	750,000	8,000	4½ % Q.	390	400
jNinth Avenue RR...........guar.	100	800,000	8[illegible]0,000	....	198	205
kSixth Avenue RR............guar	100	2,000,000	2,[illegible],000	....	200	205
lTwenty-third St. R. R. Co..guar.	100	600,000	6[illegible],000	4½ % Q.	400	410
Second Avenue RR..................	100	2,500,000	1,8[illegible],000	2 % Q., Jan.,	212	215
Third Avenue RR...................	100	12,000,000	10,0[illegible]000	$1.75 p. sh. Feb.	121	121
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,5[illegible] 000	....	65	75¼
*Union (Huckleberry) Ry..........	100	2,000,000	2,00[illegible] 000	....	190	200
Newark N. J. Aug 19						
Consolidated Traction Co of N. J...	100	15,000,000	[illegible],000,000	....	67	68
North Jersey Railway Co..........	100	6,000,000	[illegible]000,000	....	22	24
United Elec. Co. of New Jersey..	100	504,000	504,000	11¾ % A.	280½	282
Pittsburg, Pa.—Aug 19						
Allegheny Traction Co.............	50	500,000		....	27	28
oConsolidated Traction Co....com.	50	15,000,000		2 %, Jan.	20	21
Consolidated Traction Co......pfd.	50	9,478,850		8 %, Nov.	58	59
pCentral Traction Co..............	50	1,500,000		1½ % Nov.	78⅛	78¼
qCitizens' Traction Co............	50	3,000,000		6 % A.	72¾	72½
rDuquesne Traction Co............	50	3,000,000		6 % A.		
sPittsburg Traction Co............	50	2,500,000		3½ %, Nov.	..	...
Federal St. & Pleasant Valley Ry..	25	1,400,000		2½ %, July,	..½	..
Pgh., Allegheny & Man. Trac. Co....	50	3,000,000		2 %, Aug.	27	29
Pittsburg & Birmingham Trac. Ry..	25	1,500,000		1 %, Oct.	..	..
Pittsburg & West End Ry..........	50	3,000,000		5 % A., June	41	42½
United Traction Co..................com.	50	17,000,000		J. & J.	..	..
United Traction Co....................pre	50	3,000,000		J. & J.	13¼	18½

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* Unlisted. ‡ Ex div.

a The United Railways & Electric Company comprises in its organization the Baltimore Consolidated Railway Company, the Baltimore City Passenger Railway Company, all the lines of street railway operated by these companies, and also the Central Railway Co of Baltimore. The pref stock of U R & Elec Co has been issued in the form of income bonds.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250 100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranted by West Chicago Street Railway Company, lessee.

l Cincinnati St. Railway purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‖ Outstanding. ‡ Ex-div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Ry. at 8 % on stock until Oct. 1. 1897; thereafter 9 %.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1895, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock

j Leased to Met. St. Ry. for 99 years from April [illegible], 1892; 6 % first 5 years, 8 % thereafter.

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 % on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens' Duquesne, Fort Pitt & Pitt'b Traction.

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.

q Leased to Fort Pitt Traction Company for 6 % on $8,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock.

s Leased to Consolidated Traction Company for 7 % on capital stock.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.—Aug 19						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb.	160	165
Northampton, Mass—Aug 19						
Northampton Street Ry	100	300,000	225,000	4 % A., June.	170	178
Omaha, Neb.—Aug 19						
Omaha Street Ry	100	5,000,000	5,000,000	3 % A. and N.	55	65
Paterson N. J.—Aug 19						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	--
Providence, R. I.—Aug 19						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Oct.	109	110
Philadelphia.—Aug 19						
Fairmount Park Trans. Co...$50 pd.	50	2,000,000	1,770,000	2 %, Dec.	23	24
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15,	47	48
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	588,900	‡588,900	3 % S—July,	75	76
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1,	26½	27
Union Traction Co....$17½ pd	50	30,000 000	29,980,450	....	26¼	27
cElectric Traction Co	50	....	8,297,920	....	..	...
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	345	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.	450	451
fLehigh Avenue Ry. Co	50	1,000,000	....	....	48	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	90	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar.	300	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April,	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—	150	151
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan.,	151	152
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	....	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh. Oct.	96⅝	96½
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar.,	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖380,000	$6 share—July	158	157
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July	208	208¼
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$8.50 share July	100	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July	308¾	309
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '	...	..
j17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July, '	..	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖385,000	$11 sh. A., July,	300	..
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July	239	240
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '	262	268
Rochester, N. Y.—Aug 19						
Rochester Railway Co	100	5,000,000	5,000,000	....	25	28
Reading, Pa.—Aug 19						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	24	26
kCity Passenger Ry	50	850,000	850,000	Jan.,	136	...
lEast Reading Electric Ry	50	1,080,000	‡1,000,000	Jan.,	70	--
St. Louis Mo.—Aug 19						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	--	--
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec.	--	--
Lindell Ry	100	2,500,000	2,400,000	1¼ % Jan.	--	--
National Railway Co	..	2,500,000	2,479,000	1½ % Jan.	--	--
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	--	--
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct.,	--	--
St. Louis RR	100	2,000,000	2,000,000	2½ %, Jan.,	...	--
Missouri RR	50	2,400,000	2,300,000	1½ % Jan.,	--	--
People's RR. Co	50	1,000,000	300,000	50c., Dec.,	..	...
United Electric Ry...com.	50	500,000	500,000	....	27	27½
United Electric Ry.....5 % pref.	100	1,000,000	1,000,000	3 %, Jan.,	79½	81
St. Louis & Suburban Ry	100	3,000,000	2,500,000	....	90	95
Union Depot RR	100	4,000,000	4,000,000	3 % A., July,	--	--
San Francisco, Cal.—Aug						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	117	119
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share,	50	..
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	61½	68⅛
Presidio & Ferries RR	100	1,000,000	550,000	....	--	16
Scranton Pa—Aug 19						
Scranton Railway Co	50	6,000,000	2,500,000	....	29	30
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	16½	...
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	--	--
Springfield Ill.—Aug 19						
Springfield Consolidated Ry	100	750,000	750,000	....	...	--
Springfield O.—Aug 19						
Springfield Street Ry	100	1,000,000	1,000,000	....	--	11
Springfield, Mass.—Aug 19						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	207	212
Toronto Canada.—Aug 19						
Toronto Street Ry	100	6,000,000	6,000,000	1¾ % S.	109¼	110⅛
Montreal Street Railway Co	.....	4,000,000	4,000,000	4 % S.	279	280
Washington, D. C.—Aug 19						
Belt Ry. Co	50	500,000	500,000	....	--	--
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct.	103¾	103⅞
Columbia Ry. Co	50	400,000	400,000	6 % A.	--	...
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	35	40
Georgetown & Tenallytown Ry	50	200,000	200,000	....	20	21
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	--	--
Worcester, Mass.—Aug 19						
*Worcester Traction Co.....com.	100	8,000,000	8,000,000	....	32¼	35
Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb.,	107	108
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %,	...	85
Wilkesbarre, Pa.—Aug 19						
Wilkesbarre & Wyoming Val Trac	0	5,000,000	5,000,000	1 %, Jan.,	25	26

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex-div.

a Leased to Hestonville, Man & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Company at a rental of $10,000 per annum in 1866-7-8, p. a. $20,000 in 1899-1900 and $30 000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6 % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Co., formerly Scranton Traction Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 19						
American Tel & Tel Co	100	80,000,000	28,650,000	4½ % Q., Jan.	162	162¼
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Feb. 20,	48	48¼
New England Telephone Co	..	10,394,600	10,304,600	$1.50 p. sh. Feb	139	140
New York.—Aug 19						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	91	94
*Central & South Am. Teleg. Co.	100	6,500,000	6,500,000	1½ % Q.	105	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	178	175
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	42	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Feb.,	..	..
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	108	109
*International Ocean Tel Co.guar 6 %	100	3,000,000	......	1½ % Q.	116	118
Mexican Telephone Co	100	2,000,000	......		2	2½
*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	2½ % Q., Jan.,	168	178
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	70	75
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	.
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	100	110
†Commercial Union Telegraph Co.	25	500,000	500,000	3 % S., Jan.,	115	..
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Q, Jan.	93⅛	93¼
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Aug 19:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q.	36	37
Bell Teleph. Co. (of Canada.)	100	3,960,000	3,561,000	2 % S.	138	..
Chesapeake & Potomac Telep. Co.	100	......	......	....	67	70
Chicago Telephone Co	100	......	......	......	200	210
Central Dist Prtg & Telg. Co. (Pgh.).	100	750,000	750,000	....	148	150
Empire & Bay States Telegraph Co.	...	......	......	....	75	76
Hudson River Telephone Co	109	2,000,000	2,000,000	1 % Q.	120	125
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	122	126
Providence (R. I.) Teleph. Co	50	......	......	....	96	97
Southern New Eng. Teleph. Co	100	3,000,000	......	....	...	..

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 19						
Fort Wayne Electric trust receipts	..	......	......	....	115	125
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	15	25
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1893.	..	
General Electric Co. [new] ...... "	100	18,276,000	18,276,000	2 % Q., July, 1901	262	262¼
T.-H. Elec. Co..T. Secur., Series C.	..	......	......	....	22	23
Westinghouse Elec. & Mfg. Co. com.	50	......	146,700	....	70	70¼
Westinghouse El. & M'fg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q.,	78¼	79
Westinghouse El. & M'fg. Co. rights.	50	11,000,000	8,195,126	......	1¾	1⅞
New York.—Aug 19						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,988,000	....	119	120
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	2,000,000	1½ % Oct., '98.	--	..
Edison Ore Milling Co	100	......	......	....	8	12
Electric Vehicle Co.....com.	..	......	......	....	--	--
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1893.	--	...
General Electric Co. [new].... "	100	18,276,000	18,276,000	2 % Q., July, 1901	262¾	263
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	--
‖Kings Co. El. L. & P. Co.	100	2,500,000	2,500,0 00	A. & O.	116	125
Pittsburg, Pa—Aug 19						
Allegheny County Light Co	100	500,000	500,000	J. & J.	166	172
East End Electric Light Co	50	300,000	300,000	Q	--	--
Philadelphia, Pa.—Aug 19						
Edison Electric Light Co	100	2,000,000	......	......	144	144½
*Electric Storage Battery Co..com.	100	8,500,000	......	......	73	76
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	80	86
Northern Elec. Light & Power Co.	10	550,000	550,000	......	13	13½
Southern Elec. Light & Power Co.	10	187,500	187,500	....	30	--
Miscellanoeus.—Aug 19						
Bridgeport (Conn.) Elec. Lt. Co.	25	500,000	......	......	47	48
Missouri-Edison (St. Louis)....com.	..	......	......	....	20	21
Eddy Electric Mfg. Co	25	......	......	....	9	10
Hartford (Conn.) Elec. Light Co.	100	850,000	......	....	190	191
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	9	10
New Haven (Conn.) Elec. Lt. Co.	100	100,000	......	....	95	
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct.,	93	94
Rhode Island Elec. Protec. Co	100	......	......	....	118	120
Royal Elec. Co. (Montreal)	..	1,000,000	.....	1 % Q	‡250	251
Toronto (Canada) Elec. Light Co.	100	1,085,000	1,085,000	1¼ % Q	136	138
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1,	..	100
Woonsocket (R. I.) Electric Co	100	......	......	....	105	106

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

‖ Recently acquired the Edison Illuminating Co. of Brooklyn and its constituent company, the Municipal Electric Light Co.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Aug 19:						
American Electric Heating Co	50	10,000,000	....	.....	--	--
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh.	--	--
United Electric Securities Co...pfd.	100	......	1,000,000	$3.50 p.sh.	--	100
New York.—Aug 19						
Consolidated Electric Storage Co.	...	......	....	....	8	12
Safety Car Heating & Lighting Co.	100	......	....	......	150	156
Worthington Pump Co.....com.	100	5,500,000	5,500,000	......	..	--
Worthington Pump Co.......pfd	100	2,000,000	2,000,000	7 % A	113	114
Philadelphia Pa.—Aug 19						
Electro Pneumatic Trans. Co	10	1,500,000	......	--	1½	1¾
United Gas Improvement Co..scrip.	50	10,000,000	......	--	..	162
Welsbach Commercial Co.....com.	100	3,500,000	......	--	20½	21½
Welsbach Commercial Co.....pfd.	100	500,000	......	2 % Q	73	75
Welsbach Light Co	5	525,100	......	....	54	55
Welsbach Light Co., Canada.	5	300,000	......	....	1	1½
Pittsburg, Pa.—Aug 19						
Carborundum Mfg. Co	100	200,000	200,000	....	--	
Standard Underground Cable Co.	100	1,000,000	1,000,000	Q	224	227
Miscellaneous.—Aug 19						
*Barney & Smith Car Co.....com.	100	......	1,000,000	--	20	25
*Barney & Smith Car Co.....pfd.	100	......	500,000	2 %	120	129
Billings & Spencer Co	25	......	....	....	28	
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb	54	56½
Johns-Pratt Co	100	....	....	--	105	109
*Pratt & Whitney Co.....com.	100	......	....	--	..	
*Pratt & Whitney Co.....pfd	100	....	......	--	85	90
Stillwell-Bierce Co.....com.	--	....	....	--	..	58
Stillwell-Bierce Co.....pfd.	--	....	....	2 % Sept	65	70
Shultz Belting Co	100	500,000	....	....	90	99
St. Charles Car Co		......	......	......	88	94

Unlisted.

BONDS.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Albany N. Y.						
Date of Quotation—Aug 19, 1901						
The Albany Ry. Co......Cons. mtg. 5s	$500,000	427,500	1940	J. & J.	117⅛	......
†The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*116½	......
‡Watervliet Turnpike & RR. 1st mtg. 6s	350,000	350,000	1919	M. & N.	*125	....
‡Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*124	126
Troy City Railway Co..................1st 5s	....	....	1942	......	*116½	118
†Interest guar. by Albany Ry. Co.						
‡Principal and interest guar. by Albany Ry. Co.						
Baltimore Md.						
Date of Quotation—Aug 19. 1901						
United Electric Ry. Co...1st mtg. g. 4s.	38,000,000	18,000,000	1949	M. & S.	102	102¾
" " " ....income 4s.	14,000,000	....	1949	J. & D.	74¾	75
Baltimore City Pass. Ry..1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	118⅞	......
†Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	119	120
†Baltimore Trac. Co. Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	104⅛	......
†Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	121	121⅛
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	101	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	102½	......
†Central Pass. Ry. Co.........1st mtg. 6s.	96,000	117,000	1912	J. & J.	.....	....
†Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	119	121
†City & Suburban Ry.....1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	116	117
†Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	117	......
☞ All of the bonds of the above companies, marked †, have been assumed by the United Railways & Electric Company.						
Boston Mass.						
Date of Quotation—Aug 19, 1901.						
†Lynn & Boston RR........1st mtg. g. 5s.	5,379,000	3,703,000	1924	J. & D.	114	115
West End Street Ry.........Deben. g. 5s.	3,000,000	3,900,000	1902	M. & N.	104⅛	106
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	112	....
†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.						
Charleston S. C.						
Date of Quotation—Aug 19, 1901.						
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	....	....
†Charleston City Ry...........1st mtg. 6s.	350,000	....	....	J. & J.	106	....
†Controlled by Charleston St. Ry. Co.						
Chicago Ill.						
Date of Quotation—Aug 19, 1901.						
Chicago City Ry..............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¾	2¾
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T..............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	108⅛	109
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	96	96⅛
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	106	......
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	......
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	......
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	108	......
West Chicago St. RR..........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	......	111
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	101	103
West Chicago St. RR.....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	106⅝	107
‡W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	....	....
†Redeemable at option on 60 da. notice.						
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.						
¶Subject to call after Oct. 1, 1899, at $110 and interest.						
‖Assumed by W. Chi. RR. Co., lessee						
‡Int. guar. by W. Chicago St. RR. Co						
Cincinnati O.						
Date of Quotation—Aug 19 1901.						
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	114⅛	115
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103½	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	114	......
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	581,090	581,000	1906	M. & S.	108¾	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	121½	122½
‡So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	132¾	137
† Assumed by the Cincin. St. Ry. Co.						
‡$250,000 reserved to retire 1st mtg. bds.						
Cleveland O.						
Date of Quotation—Aug 19, 1901.						
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106½	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	113½	114¼
Cleveland City Cable Ry.....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	105½	106
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	8,500,000	1,249,000	1913	M. & S.	106	107
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
aEast Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	......	107½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....
†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.						
‡Interest guar. by Cons. St. Ry. Co.						
Detroit, Mich.						
Date of Quotation—Aug 19, 1901						
†Detroit Citizens' St. Ry......1st mtg. 5s.	7,000,000	3,885,000	1905	A. & O.	......	102½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry..................1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	105	106½
†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						
New Haven Conn.						
Date of Quotation—Aug 19, 1901						
New Haven St Ry...........1st mtg. g. 5s...	600,000	600,000	[illegible]		111	....
New Haven, Edgewood Div., 1st mtg. 5s.	[illegible]	250,000	1914	J & D	111	......
Winchester Avenue RR., 1st mtg. g. 5s..	[illegible]	500,000	1912	M& N	109	......
Winchester Avenue RR..... Deben 5s,	[illegible]	[illegible]	[illegible]	M& S		

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Orleans La.						
Date of Quotation—Aug 19 1901.						
Canal & Claiborne RR.....cons mtg. 6s	$150,000	$150,000	1932	M. & N.	......	....
Crescent City RR.............1st mtg. 6s	....	50,000	1899	M. & N.	105⅛	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1946	J. & J.	......	.....
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	106	112
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	112	113
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	......
Orleans Railroad Co........Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	......	......
‡St. Charles St. RR. Co......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	......	......
†$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.						
‡$90,000 outstanding.						
New York.						
Date of Quotation—Aug 19 1901.						
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	......
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107⅛	110
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	115	116
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	123	125
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	105
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	108	110
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	115	116
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	101	....
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	......
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	112	....
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	107	....
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	108	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	98	100
Cent P'k, N. & E. R. RR. 1st cons. mtg. 4s.	1,200,000	1,200,000	1902	J. & D.	107	109
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	125	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	101	103
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1932	J. & D.	117	120
Dry Dock, E. Bd'y & Bat'y RR..scrip 5%.	100,000	1,100,000	1914	F. & A.	102	105
Eighth Av. RR. Co.....Cert. indebt. 6%.	000 000	1,000,000	1914	F. & A.	103	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	,200,000	1,200,000	1910	M. & S.	116¼	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	89	......
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	124	125
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	120	......
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	120	121
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	108⅛	109
Steinway Ry. (L. I.).........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	116	117
South Ferry RR. Co............1st mtg. 5s.	350,000	350,000	1919	......	110¼	112
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	......	125
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	.....	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	106	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	116
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	114
†$1,085,000 in escrow to retire gen. mtg. bonds.						
‡$4,850,000 in escrow to retire maturing obligations.						
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.						
§In treasury, $80,000.						
‡‡ Guar. by Union Ry. Co.						
Toronto Canada.						
Date of Quotation—Aug 19 1901						
Montreal St. Ry.......................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M & S.	....	....
†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.						
Philadelphia.						
Date of Quotation—Aug 19, 1901						
Continental Pass. Ry............1st. mtg. 6s	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry......................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry...................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1948	...	....	....
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J &	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s.	1,800,000	1,018,000	1917	F. & A.	......	......
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...............Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	——	......
West End Passenger Ry.......1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	......	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	......	......
§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
Pittsburg. Pa.						
Date of Quotation—Aug 19 1901						
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	111⅛	....
Central Traction Co...............1st mtg. 5s.	875,000	875,000	1930	J. & J	......	......
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co..........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	.....	......
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg...............5s.	750,000	750,000	1928	M. & N.	110	113
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	113
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co.....................5s.	2,500,000	2,039,000	1934	J. & D.	......	....
Sub. Rapid Transit Railway Co..........5s.	500,000	500,000	1912	M. & S.	.....	....
Providence R. I.						
Date of Quotation—Aug 19 901						
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	116	118
St. Louis.						
Date of Quotation—Aug 19, 1901.						
Baden & St. Louis RR.........1st mtg. 5s	250,000	250,000	1913	J & J	103¼	.. ...
Cass Ave. & Fair Gds Ry......1st mtg. 5s	1,813,000	1,813,000	1912	J & J	103¼	......
Citizens' Railway Co.......1st mtg. 5s	2,000,000	1,500,000	1907	J & J	109	
Comp. Hts. Un. De. & Mer. Ter.—1s	1,000,000	[illegible]	[illegible]	J & J	[illegible]	

With interest Unlisted

With interest

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Aug 19 1901.						
Jefferson Avenue Ry.............1st mtg. 5s.	270,000	270,000	1905	M. & N.	102	108
Lindell Ry. Co......................1st mtg. 5s	1,000,000	1,000,000	1911	F. & A.	107	108
Missouri RR. Co....	1,000,000	700,000	1916	M. & S.	105	106
‡Mound City RR. Co..............1st mtg. 5s.	400,000	300,000	1910	A. & O.	104½	105½
People's RR. Co....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	....	.....
‖People's RR. Co.....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	......	......
People's RR. Co...............Cons. mtg. 6s.	1,000,000	900,000	1904	J. & J.	......	......
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co......................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	99½	100½
§St. Louis & Sub. Ry.........1st mtg. g. 6s.	2,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry..................Income 5s.	300,000	300,000	......	....	80	84
††Southern Electric Ry....Cons. mtg. 5s.	300,000	300,000	1900	M. & N.	106	108
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	300,000	500,000	1913	J. & J.	116½	117½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,001,000	1900	A. & O.	100	100½
Union Depot RR. Co.........Cons. mtg. 6s.	6,500,000	1,787,000	1913	J. & J.	121	123
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Aug 1901.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	117
Geary St., Park & Ocean RR. 1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	......	65
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	128½	......
†Metropolitan Ry. Co..................1st mtg.	200,000	....	......	....	.....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	128½	......
†Park & Cliff House RR.........1st mtg. 6s.	350,000	350,000	1912	J. & J.	105½	107
†Park & Ocean RR..................1st mtg. 6s.	250,000	250,000	1914	J. & J.	115	......
†Powell St. Ry.........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	125
Sutter St. Ry. Co....... ....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Aug 19. 1901						
Belt Ry. Co..............................Cons mtg 6s.	500,000	450,000	1920	J. & J.	......	....
Columbia Ry.......................... 1st mtg. 6s.	500,000	500,000	1914	A. & O.	122	......
Eckington & Soldiers' Home 1st mtg. 5s.	200,000	900,000	1911	J. & D.	......	......
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	......	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Aug 19, 1901						
Bridgeport Traction Co.........1st mtg. 5s.	2,000,000	1,000,000	1923	J. & J.	108	110
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,542,000	1931	F. & A.	118	....
†Citizens' St. R. (Ind'polis). 1st cons. m. 5s	4,000,000	3,000,000	1923	M. & N.	104	105
‡Crosstown St. Ry. (Buffalo). 1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	112	113
§Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	115	...
Consolidated Traction (N. J.). 1st mtg. 5s	15,000,000	13,985,000	1933	J. & D.	111¼	111¾
‖Cross't'n St. Ry. (Colu's, O.). 1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	115	115½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,300,000	1930	J. & J.	20	..
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	85
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	119	119½
¶Minneapolis St. Ry. 1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	110½	110¾
††No. Hudson Co. Ry. (N.J.). Cons. mtg. 5s	6,000,000	2,578,000	1928	J. & J.	106	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	650,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.).......Deb. 6s.	500,000	499,000	1932	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	....	......
Rochester (N. Y.) Ry............1st mtg. 6s.	3,000,000	2,000,000	1930	A. & O.	......	......
St. Paul City Ry.........................Cons. g. 5s.	5,500,000	4,298,000	1937	......	105½	106
St. Paul City Ry..........................Deb. g. 6s.	1,000,000	1,000,000	1900	......	106	...
†$1,000,000 in escrow to retire 1st and d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
§$760,000 in escrow to retire bonds of C. St. RR. Co.						
‖$87,000 in treasury.						
¶$960,000 res'ved to redeem prior liens						
††$620,000 in escrow.						
					*With int're	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS

Boston, Mass.						
Date of Quotation—Aug 19, 1901.						
Delaware Gas Lt. Co.,..........1st m. 5s, g.	300,000	300,000	......	J. & J.	106	108
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	157	...
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	116	.....
Pittsburg Pa						
Date of Quotation—Aug 19. 1901						
Allegheny County Light Co........ ....6s.	500,000	......	1911	J. & J.	110	......
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	......	......	M. & S.	...	......
Miscellaneous.—(Aug 19 1901.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	109	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,156,000	1995	......	124	......
Edison Elec. Illg. Co. (Brooklyn)........	5,000,000	5,000,000	1940	....	122½	124
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	...	.....
Kings Co. El. Lt. & Pow. Co. 1st mtg. 5s.	2,500,000	.....	1937	A. & O.	100	105
Kings Co. El. Lt. & Po. Co. pur. money 6s	5,176,000	......	1997	A & O.	120	122
Milwaukee El. Ry & Lt. Co. 1st con. g. 5s.	3,000,000	......	......	F. & A.	102½	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	...	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Aug 19 1901					100½	101
American Bell Telephone.......................4s.			1908	F. & A.	......	.
Northwestern Telegraph Co................7s.	....	......	....	......	....	.....
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	114	118
Chesapeake & Potomac Teleph. Co....5s.	....	......	1911	J. & D.	105	106

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Aug 19 1901						
American Electric Heating............. 7s	500,000	500,000	....	....	....	......
Armington & Sims Engine Co.............	....	....	......	......	......	25
Barney & Smith Car Co.......................6s.	....	....	1942	J. & J.	106	107
Carborundum Mfg Co...........................6s.	....	....	1904	J & D.	......	......
Worthington Pump Co........................	75,000	....	......	......	115	127

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 16⅝@16⅞c.; Lake, 16¾@17c.; casting, 16½@16¾c.

Changes in the directory of the Electric Company of America are expected at the next annual meeting.

The Union Traction Company of Albany, N. Y., has sued the city and the county to recover damages sustained from the strike last spring.

The American Railways Company of Philadelphia has declared a dividend of 1 per cent., payable September 16. Books close August 30, and reopen September 20.

It is asserted in Chicago that the Illinois Telephone and Telegraph Company has sold $3,000,000 bonds, and will have 15,000 telephones in operation by spring.

A cable dispatch from London says that C. T. Yerkes will buy the interests of the companies controlling the Ganz electrical system if he cannot get the use of the system in any other way.

The Hudson Valley Electric Railway Company, a consolidation of the electric railway systems from Troy to Lake George, was incorporated at Albany, N. Y., on the 16th inst., with a capital of $2,600,000.

The Kings County Electric Light and Power Company (Brooklyn) has declared the regular quarterly dividend of 1½ per cent., payable September 3. Books close August 24 and reopen September 3.

The Philadelphia "News Bureau" says: "The Union Traction Company accounts for the year ended June 30, 1901, have now been made up, and will show in the stockholders' report surplus earnings for the year of $861,000 over charges of all kinds.

Justice Stover, of the Supreme Court, Brooklyn, on Monday handed down a decision by which the Nassau Electric Company, now a part of the Brooklyn Heights Railroad Company, is enjoined from constructing trolley tracks on Union street in Brooklyn.

A London cable says that the reports there and in New York of an extended copper trust are partly believed. It is considered that unless some such step is taken the present situation, with the falling off in demand for the metal, might mean a dangerous drop in prices.

The advance in General Electric is largely due to the revival of the report that the directors will very shortly do something to reimburse the stockholders for the reduction of stock made some time ago. Just what form this reimbursement will take has not yet transpired.

The Staten Island (N. Y.) Midland Railroad Company reports for the quarter ended June 30, 1901: Gross earnings, $33,454; decrease, $1,968; net earnings, $11,474, decrease, $1,689; deficit after charges, $1,026; increased, $1,688. The balance sheet shows a profit and loss deficiency of $70,103.

The following are quotations for some of the industrial stocks not quoted elsewhere: Electrical Lead Reduction, 1⅛@1⅜; Electric Boat, 18@22; Electric Vehicle, 5½@7; Tel. & Tel. Company of America (full paid), 3@6; Electric Company of America, 7@7¼; National Carbon, 17@17¼.

The sale of the Newburg (N. Y.) Electric Railway and connecting lines will take place at the court house in Newburg on Friday, September 20, at noon. It includes the road in that city, the Newburg and Orange Lake line, and the Orange Lake and Walden line, also all lands, cars, etc., and leases.

The annual report of the American Railways Company of Philadelphia, which will be presented to stockholders next month, has been made up, and is now receiving verification at the hands of expert accountants. It is claimed that the report will show a surplus, after dividends, of about $75,000.

Negotiations are said to be in progress for the sale of a controlling interest in the Market Street Railway Company of San Francisco to an Eastern syndicate. The par value of the company's stock is $18,617,000. H. E. Huntington, president of the road, is now in New York, and is said to be conferring with the capitalists who desire to purchase the property.

At the Central Union Telephone directors' meeting in Chicago on Thursday last it was the opinion that the present issue of capital stock be reduced one-half, and then increase the capital stock so reduced 100 per cent., which will bring into the treasury substantially $3,500,000 in cash. The matter will be put before the stockholders at once for the necessary action.

The General Electric Company has extended the period for the exchange of preferred stock for common stock up to and including August 31. There is remaining outstanding but a very small amount of preferred stock, but it is considered advisable that all owners of the preferred stock should exchange for common stock, and there may be no further opportunity to do so after August 31.

Wall Street expects that the next move in the steel strike will be a stampede of the men to get back their old places, and much store is laid on the trade reports of the United States Steel Corporation's position. In the trade, declares an authority, it is considered that the strike is already lost, and that the only question to be settled is how long the men will "loaf" without wearying of it and consuming their too slender resources.

The United Traction Company, of Pittsburg, one of the collateral interests of the Philadelphia Company, which owns practically all of the 340,000 common shares is reported to have produced $223,881 net revenue for the Philadelphia Company for the year just closed, June 30, 1901. The earnings of this traction property, both gross and net, have shown a material growth since the consolidation three years ago. As the electric light company owned by the Philadelphia Company earns $300,000 net, the aggregate profits of these two properties is said to be sufficient to more than pay the interest on the Philadelphia Company bonds and preferred stock outstanding, amounting to about $403,645 per annum.

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EDITORIAL NOTES.

The Institute Meeting in Buffalo.

The annual meeting of the American Institute of Electrical Engineers, which drew to a close last Saturday at Buffalo, came up to all anticipations. Some half dozen interesting papers were read and quite thoroughly discussed in spite of the fact that the afternoons were devoted to sightseeing.

On the afternoon of August 20 Niagara Falls and the Gorge Road were visited by daylight and on Wednesday evening by searchlight illumination. Time was found to visit several power plants in Buffalo, among others that of the Terminal Company which receives power from Niagara. The Wilkeson station of the electric light service was inspected, as well as the Eagle street power house of the trolley company.

The fireworks in the evening were most elaborate, but unfortunately on August 22, "Electrical Day," through an unforeseen accident, the electric power gave out for a short period which somewhat marred the illumination, and was all the more to be regretted owing to the presence of the foreign guests.

* * *

Some Figures About Trolley Lines.

Mr. W. J. Sherman, a civil engineer of Cornell University, has made an investigation of the cost and profit of operating trolley lines and gives the results in a late issue of the "Railroad Gazette." Just at present a large number of companies are organizing to build electric lines, as will be seen by reading the news columns of ELECTRICITY, and owing to this fact Mr. Sherman's observations will be read with interest.

He finds that the cost of construction per mile in Massachusetts has been about $20,000. At this rate he calculates that it requires gross earnings of $3,000 per mile to pay interest. Pursuing his investigations, Mr. Sherman puts the urban and interurban railroads together and averages the receipts. He finds that the urban railroads of Ohio earned an average of $10,193 per mile, and the interurban roads $3,824 per mile, while the average gross earning of all the electric railroads, both urban and interurban, was $8,354 per mile, against $10,452 for Massachusetts and $24,445 for New York. The difference in density of population accounts for the difference in returns.

The tenor of Mr. Sherman's arguments is in favor of roadbeds equal to those of the steam roads, easy grades and a perfect track. The transmission of power, he thinks, will be successfully worked out, and his opinion is finally that the roads can be made to pay good dividends to the investors. Up to the present, nearly all the earnings have come from passenger business, but a profitable freight traffic is predicted. "To the writer," says Mr. Sherman, "the volume of the earnings of some of the existing lines is a constant source of wonder," and he confesses to having mentally prophesied failure in a number of cases where success has attended the actual operations. It is, he says, a singular thing how business is actually created where there was promise of little or none, by supplying facilities which the public has never felt the need of. It seems the denizens of the rural districts are quick to realize that it is cheaper to send the women on their shopping trips by the trolley than to withdraw horses and a driver from farm service.

* * *

Meeting of Municipal Electricians.

The sixth annual convention of the International Association of Municipal Electricians will be held at Niagara Falls, N. Y., next week, with headquarters at the International Hotel.

The sessions will begin on the afternoon of Monday, September 2, when the president will make his annual address and the report of the executive committee will be read. A paper on "Need and Value of a Set of Rules for Outside Construction" will be presented by P. H. Trout, Jr., city electrician of Lynchburg, Va.

On Tuesday, September 3, special committees will report and these papers will be read:

"Municipal Control vs. Municipal Ownership," E. F. Schurig, city electrician, Omaha.

"Inadvisability of Placing High and Low Potential Wires Through the Same Series of Conduits, or Through the Same Manholes," William Brophy, Boston, Mass.

"The Protection of Fire and Police Telegraph Wires from High Tension Currents and Lightning," W. M. Petty, superintendent fire telegraph, Rutherford, N. J.

"Improved Storage Battery for Municipal Purposes," J. W. Aydon, superintendent fire and police telegraph, Wilmington, Del.

The social features of the Convention will be everything that can be desired, especial pains having been taken to provide amusement and entertainment for the visiting ladies. There will be a drive through the Park, a trip through the Gorge to the Whirlpool Rapids and return and an excursion on the Maid of the Mist. On the evening of September 3 a hop will be given.

Altogether the meeting promises to be a successful one from every point of view.

* * *

Novel Street Railway Proposition.

The municipal authorities of Chicago are now considering the renewal of some of the street railway franchises in that city which will expire next year. A lawyer, who represents a company with large financial resources, has made an offer of a decidedly novel character, and says he is prepared to furnish bonds to carry his proposition into effect.

The city is asked to grant the petitioning company franchises for street car lines on all the streets now occupied by the companies whose franchises are soon to expire. In return for the franchises the company is to build and equip an up-to-date street car system under the supervision of the city, and the city is also to have power, within certain limits, to direct the manner in which the lines shall be operated. The city is to reserve authority to buy out the company at any time it wishes to acquire the property. The fare is to be 5 cents for a continuous ride.

The novelty of the proposition is the manner in which the city is to be compensated for its grant of the franchises. Out of the receipts of the lines the cost of operation and maintenance must first be met, and a reasonable sum set aside for needed extension. Enough of the net income is then to be reserved to pay dividends of 5 per cent. on the investment. Whatever remains after these two items of expense have been provided for is to be turned over to the city.

This is a radical departure from the usual plans for the division of the receipts between the company and the city. These generally contemplate payment into the city funds, either in the form of a trackage rental or a percentage of the gross receipts, in either case the payment to the city taking precedence of operating expenses, bond interest and dividends. In the Chicago proposition all expenses of operation and maintenance and a fixed dividend of 5 per cent. are to be met first, and the city is to have what is left.

Whether anything would remain for the city, under this arrangement, might depend on the ideas of the management about salaries, other operating expenses and betterments and on the amount of water in the capital.

* * *

Government Officers Have a New System

A report from Washington says that the Signal Service has about perfected a system of wireless telegraphy which the Government proposes to put into practical operation first on the Pacific coast, and which is understood to be a great improvement over the Marconi system. The officers who are in the secret are Capt. Russell, Col. Reber and Col. Dunwoody, of the Signal Corps. As a Government invention its usefulness will first be applied to communications at San Francisco between shore stations and the Government transports. It is proposed at an early date to put up suitable stations at San Francisco and to equip the transports with apparatus in accordance with the Signal Corps ideas. Capt. Russell says that at this time it would not be proper to say anything in detail about the matter. It is understood, however, that the Signal Corps people are satisfied they can now receive signals from a distance of at least thirty miles. The Government system is already working at San Francisco effectively between shore stations. Thirty miles is, of course, only a beginning. It is confidently believed that there will be a much greater extension of effectiveness, and that, in fine, there may be no limit to the communication. It is not denied that the general plan, as laid down by Marconi, has been kept in mind by the Government inventors. At the same time it is noted that Marconi was not the discoverer of the principle which is to be utilized, and that the general principle is merely that of the Hertzian wave.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

Dr. W. Esty has been appointed assistant professor in the electrical engineering department of Lehigh University.

◆

The shrinkage in British railroad dividends consequent upon the steady and uncheckable depreciation of shares is discussed by Mr. Robert P. Porter, in a letter to the London "Times," from the standpoint of electrical railroads, which already cause reduced profits. Mr Porter finds that the only salvation is in electricity. He says: "For the purposes of concentrating the population in the morning and distributing it at night the steam locomotive must give way to the electric. It is like putting a steam hammer in motion to crack a nut."

◆

The General Electric people are reported to be spending considerable time and money endeavoring to get a suitable copper property; in fact, they have had experts looking over the field for many months. The company purchases between 30,000,000 and 40,000,000 pounds of copper a year at a cost of between $5,000,000 and $6,000,000. If a good property could be secured which would be capable of development into a mine producing, say 1,000,000 pounds of copper per month, it would be a profitable investment for the General Electric, so officials of the company assert.

◆

A dispatch to the "Daily Mail," London, from Copenhagen says that Dr. Sophus Bang, manager of the laboratory belonging to Prof. Finsen, inventor of the light cure for lupus, has constructed a special electric lamp, giving a feeble light, but which is extremely rich in chemical rays. The dispatch adds that Dr. Bang used metal instead of carbon poles. The bacteria-killing power of this lamp is ten times as great as that of an ordinary arc lamp and a lupus patient requiring seventy-five minutes' treatment with the arc lamp will require only from three to five minutes' treatment with the new one, which costs only $15.

◆

The Toronto "Star" says: "A new game has been introduced into the city—invented here, because it is not known to be played elsewhere. Its only implement is any ordinary electric fan. The four flanges of the fan are marked, and each player puts up a sum of money to support his belief that his particular flange will stop at the top when, the power being turned off by means of the switch, the fan of its own accord stops revolving. There are four flanges on most ordinary fans, and this easily allows four players to bet at one time. Fewer than four can also play. Some people may recognize a similarity in principle between this game and roulet. But it is much more easily played."

◆

As recorded in Electricity of July 31, on July 27 a successful test of the operation of the Marconi system of wireless telegraphy was made between the steamships Kaiser Wilhelm der Grosse and Lucania, when messages were transmitted a distance of twenty miles. On August 24 these same ships repeated the experiment, with the result that communication was kept up until a distance of thirty miles separated them, or until the Lucania had passed Sandy Hook.

◆

The work of setting the plant for the lighting of the Lachine Canal by electricity has been commenced, and will, it is expected, be completed in time for next season's business.

◆

Employes of the General Electric Company of Schenectady have completed arrangements for what will prove the largest excursion that will go to the Pan-American Exposition. The company has granted its employes four days, beginning August 30, and it is expected that from 5,000 to 6,000 employes and their families will go on the excursion.

◆

An American syndicate, at the head of which is a Standard Oil man, has bought Cow Bay Beach, near Halifax, Nova Scotia. The beach will be improved and placed on a footing with watering places in the United States. An electric railway will be laid from the town of Dartmouth, opposite Halifax, to the beach and a large hotel erected there.

◆

A dispatch from Carlisle, Pa., says that Daniel Drawbaugh, the aged farmer of Eberly's Mill, who fought Alexander M. Bell for the telephone patents a score of years ago, has struck upon a system of wireless telephony and telegraphy which, he says, promises to revolutionize the business. Unlike Marconi, who makes use of the other currents, Drawbaugh has formed strong electric currents in the earth and uses the ground as a medium. His sending apparatus is an instrument capable of producing a high number of electrical vibrations. This is attached to the ground by a wire and copper plate. A similar grounding device connects the earth with the receiving instrument. The common telephonic and telegraphic instruments in ordinary use are used for receiving and sending messages. Mr. Drawbaugh has successfully used earth currents for message transmission for half a mile.

◆

The Dominion Government has decided that the illumination of the Parliament Buildings, during the visit of the Royal party at Ottawa, shall be the finest electrical exhibit, in comparison to the size, that has been seen on this continent. Acting in concert with Messrs. Ahearn & Soper, of Ottawa, who have the contract, the Deputy Minister of Marine has secured designs of the Buffalo illuminations, and the plans, now being worked out, are adaptations of these illuminations. The great buildings will be illumined, not from the prominent lines, but from the recesses. The electric light will shine out from the darkest points into the night. All the windows are being picked out in this way, and the cornices over arches, etc., while the big central tower will be framed in electric lights in somewhat the same manner as the great electrical tower at the Pan-American Exposition. The whole effect will be most beautiful.

◆

The development of water power in France was marked recently by the completion of a new central power station at Sant du Martier for the distribution of electrical energy, says the "Electrical Engineer," London. The River Ain, which at its source partakes of the nature of a torrent, supplies the motive force for the generation of electricity. With a minimum supply of 141 cubic feet the available force would not exceed 600 hp., and in order to secure a reliable supply of 3,000 hp. a canal has been constructed which reinforces the river in time of drought from the waters of the Chalain Lake, situated about 30 miles distant from the power house. At present the power station contains four units, each direct-driven by a Piccard and Pictet turbine of 700 hp. Three-phase 7,500 volt Oerlikon alternators are used. This station supplies light and motive power to the towns within a radius of 13 miles, and it is intended to install another unit very soon.

◆

The American Electric Telephone Company of Chicago has just secured an order for 8,000 sets of instruments from the Keystone Telephone Company of Philadelphia.

◆

President Greatsinger of the Brooklyn Rapid Transit Company has decided to equip the tracks of the company's various lines with derailing switches at signal stations.

◆

Nearly 200 members of the American Association for the Advancement of Science were present on Monday at Denver, Col., when its fiftieth annual convention was called to order by Prof. R. S. Woodward, the retiring president. Prof. Charles S. Minot of Boston was installed as the new president.

Operating officers of the New York Central Railroad have prepared a plan designed to do away with the smoke and gas nuisance in the Park avenue tunnel of this city, through which more than 500 trains are hauled daily by steam locomotives. As this much-complained-of tunnel is now operated, two tracks extend through the central section, which is ventilated by frequent large openings into Park avenue, these openings being inclosed and partly concealed from view on the avenue by iron railings and hedges. On each side of this section is a dark tunnel accommodating a single track. These side tunnels are ventilated only by side openings into the central section. It is the purpose of the plan to devote these side tunnels entirely to suburban traffic, which is to be operated by electro-motive power. The estimated cost of the proposed change including a more thorough system of ventilation is between $6,000,000 and $7,000,000.

◆

The Chicago Great Western Railway Company contemplates the installation of electric motor power for all its suburban service within a radius of thirty miles of St. Paul. This new departure is a forerunner of the evolution in suburban traffic and local railway transportation. It means steam railroads for the long haul and electric railroads for the short haul.

◆

An Austrian electrician has devised a telephone which takes care of itself. It has a phonograph attachment, and when the owner is away from home, he simply sets the machine to say to those who call him up: "I am away from home. The phonograph will take the message."

◆

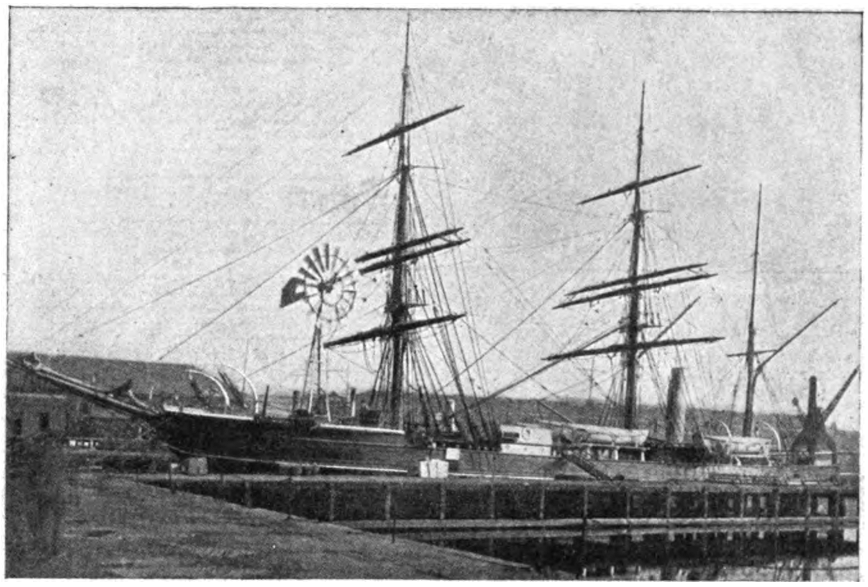
At Bay City, Mich., at Saginaw, Mich., and at Ellenville, N. Y., the city electric-light plants are operated by women.

◆

The story of why the Madison Street Railway Company of Indianapolis, Ind., disposed of the services of female conductors was related to the State Tax Board recently by officers of the company who were presenting an appeal from the assessment made by the county board of review. It was explained that female conductors were first employed because they were cheaper than men, and because it was believed they would increase the traffic over the line. In this latter belief the officers say they were seriously disappointed. Instead of attracting male passengers, the women conductors invariably showed a preference for some particular man, and the others became jealous. Superintendent J. B. Johnson assured the State Board that it finally came to a pass that each car carried but one passenger, he and the female conductor being engaged in animated conversation. Although the female conductors were replaced by men several months ago, the business of the company has not revived and the officers of the company feel that they are assessed too high.

◆

The Woodsfield (O.) Telephone Company met a short time ago and effected an organization for its management by electing J. B. Rhodes, of Zanesville, president; L. E. Stegner, Lewisville, vice-president; J. S. Cawley, Woodsfield, secretary and treasurer. The board of directors is composed of the above named gentlemen and E. A. Culbertson, of Coraopolis, Pa.



The Steamship Discovery.

ANTARCTIC ELECTRIC LIGHTING.*

There have been several references in the daily papers during the past week to the wind-power installation of the electric lighting plant with which the steamship Discovery has been equipped. Through the courtesy of Messrs. Bergtheil and Young, who designed and supplied the apparatus in question, we are able to give a technical description of the same. The ship in question does not carry an unlimited quantity of coal from which to obtain electric light, and hence there was a need felt for a wind-power plant which should render the would-be Discoverers independent of coal storage for their lighting. The work of equipping the ship was superintended by Mr. Arthur Bergtheil, who adopted the following devices for securing constant voltage at the lamps, in spite of wide variations in the speed of the dynamos.

The apparatus consists of a dynamo having a capacity of 1.25 kw. at 50 volts, and another dynamo having a capacity of about 1 kw. at about 40 volts. These two generators are connected in series, the smaller machine opposing the larger. A shunt field switch is included, and provided with a solenoid controlling gear. The excitation is taken off the main terminals. In the normal position of exciting switch No. 1 contact the following action takes place: The windmill drives the armatures of both the dynamos at, say, 500 revolutions per minute, at which speed the large machine will give 60 volts. With the shunt regulating switch on contact 1 the full excitation is on the large generator while all the resistance is in shunt of small generator, which results in 60 volts being obtained on the main terminals. An automatic switch then closes the circuit to the cells, which are charged up. Should the speed of wind increase, the EMF. on large generator will go up, consequently the solenoid on the regulating switch will overcome the weight and put resistance into the large dynamo field, and cut some out of the small dynamo field. This has the effect of again adjusting the voltage to normal. By this arrangement a practically constant voltage is secured with a range of speed varying from 500 to 2,000 revolutions per minute. This range was actually obtained on trial in the London Docks before the Discovery went to sea.

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*From the "Electrical Engineer," London.

The entire plant is extremely compact, and is so designed that it can be stored away in the hold of the ship until she arrives at her destination. In the event of it becoming necessary to light observation cabins or instrument sheds in the vicinity of the vessel, flexible cables have been provided with lamps attached so that these may be illuminated from suitable plugs placed about the ship. The windmill is so designed that it may be placed complete with its dynamos at a distance of 200 yards from the vessel for the purpose of obtaining the very best results from the wind, and connected to the vessel by means of a large armored cable wound on a drum. The windmill is 20 feet high, with a driving wheel 12 feet in diameter, developing in a 15 mile wind something like 3 hp., geared to drive the vertical shaft at 200 revolutions per minute and the driving wheel of the generator at 500 revolutions per minute. The windmill was manufactured especially for this plant by Messrs. Alfred Williams & Co., of Old Ford-road, Bow, and is of American type, so constructed that it can be easily shifted from one point to the other or packed away in a small compass. The dynamo was built especially for this installation by the Newton Electrical Works, Limited, of Taunton.

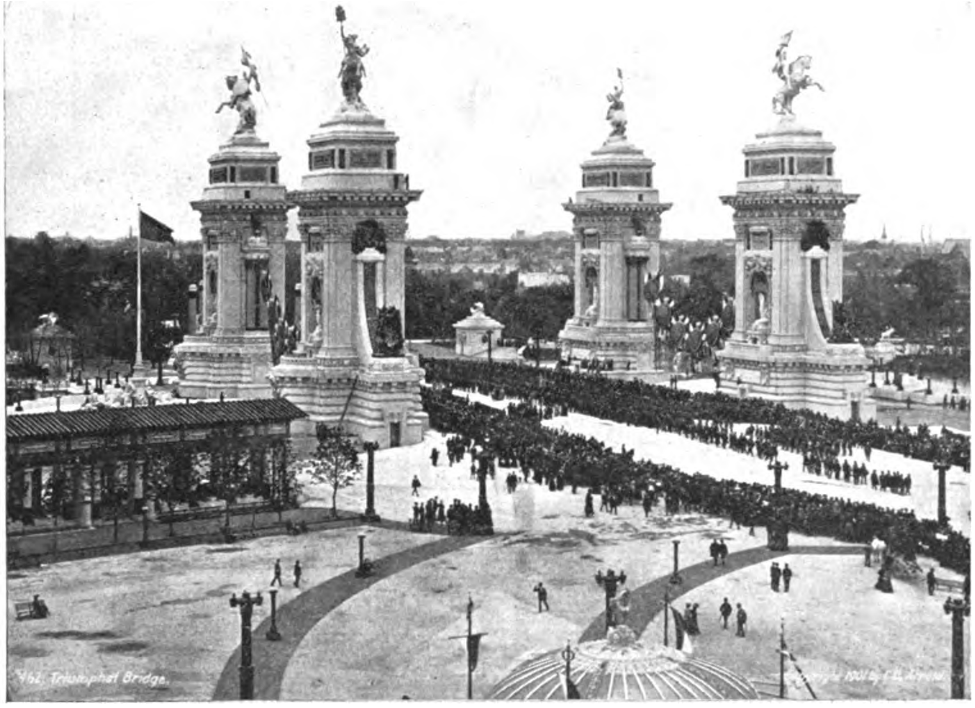

FIG. 1.—TRIUMPHAL BRIDGE, PAN AMERICAN EXPOSITION.

Tokio's Electric Railway.

The newspaper "Japan and America" says the movement, begun some time ago, to construct an electric railway in Tokio, is now assured of success. A general meeting of the Tokio Electric Railway Company was held recently to consider new plans. The result was that an entirely new programme was adopted. The work of construction will be commenced at once between the Shinamachi-Meguro and Hiroo-Kanasugi sections. The paid-up capital of the company now amounts to 8,000,000 yen, which is deemed sufficient to guarantee the steady carrying out of the plans for the enterprise.

PAN-AMERICAN SCENES AND EXHIBITS -VII.

BY FRANK C. PERKINS.

The Triumphal Causeway or Triumphal Bridge at the Pan-American Exposition is one of the most artistic and imposing structures at the fair. Each of the four columns seen in the accompanying illustration, Fig. 1, is surmounted by a beautiful equestrian statue, which stands out at night in pure white when illuminated by the powerful rays of the enormous searchlight at the top of the Electric Tower. The electrical decorations of the Triumphal Bridge are particularly pleasing and a night scene will be given in ELECTRICITY at an early date.

The architecture of the Agricultural Building as well as the coloring and staff designs are most interesting and attractive during the day, as seen in illustration, Fig. 2, with the Court of Fountains in the foreground and the Electric Tower Fountain Basin at the left. This building is located at the right of the Electric Tower and the reflection of its beautiful electric decorations is splendidly shown in the Electric Tower Fountain Basin, shown in the foreground of the illustration, Fig. 3. The exhibits in the Machinery Building, illustrated in Fig. 4, include the Buffalo Electric Carriage Company, and the "20th Century" at the left, the pavilions and booths of the Eastman Automobile Company and the Veeder Manufacturing Company at the right, and the De-Dion-Bouton Motorette Company in the immediate foreground.

* * *

A 160-foot mast has been set up at Siasconset, Mass., for the wireless telegraph station which will receive messages from the Nantucket lightship. Ground connections were made by placing 8 heavy metallic plates, 2½x8 ft., in the ground.

RULES FOR THE AMERICAN STREET RAILWAY ASSOCIATION EXHIBITS.

The exhibit committee of the American Street Railway Association has issued a circular giving the rules to be followed by exhibitors at the convention, October 9-11, to be held in Madison Square Garden, New York.

(1). The exhibition will open October 9, 1901. The building will be open for the reception of exhibits, commencing Saturday, October 5, 1901. They should be consigned to the exhibitors to whom they belong, care Madison Square Garden, New York, freight prepaid. Under no circumstances will exhibits be received on which there are charges of any kind.

All apparatus or material for exhibits should be shipped so as to arrive in New York not later than Saturday, October 5.

(2) Exhibitors should give notification in writing, before September 1, of such connections as are desired in their space, in the nature of electric lights or power, all such connections to be made at the exhibitor's expense.

The building will be well lighted, but any exhibitor so arranging his exhibit as to shut off the light must provide interior lighting at his own expense.

Current for special lighting or power will be furnished at the lowest market prices.

(3) All electrical construction must be done in strict accordance with the rules of the New York Board of Fire Underwriters and municipal departments, covering such work, and certificates for same must be secured prior to the opening of the exhibition.

(4) The floor of the exhibition building is constructed so as to support fairly heavy weights, but in order to insure the safety of apparatus exhibited and to prevent any damage to the floor, exhibitors should submit to the director of exhibits by September 1 a floor plan diagram showing proposed arrangement of their exhibits, and in the case of heavy apparatus, description of the articles to be exhibited with their weights. The director can then, at small expense to the exhibitor, arrange with the official carpenter of the exhibition building to construct extra supports under that part of the floor where heavy apparatus is to be placed, thereby placing responsibility upon the owners of the building for any possible damage to the floor.

(5) Height of platform shall not exceed 5 inches unless by special permission.

Decorations, booths, or other structures, shall be so arranged as not to exclude the light from adjoining exhibits, and in every instance the sides of these decorations, booths, or structures, facing an adjoining exhibit, shall be neatly finished, so as not to present a bare or ugly appearance in the adjoining exhibitors' space.

In sections A, B, C, D, E, F, H, H_2, I, J, K, L, M, M_2, W, X and Y decorations, booths or structures shall not exceed 10 feet in height. The committee would suggest, however, that no booths or structure be erected in these sections.

(6) It has been considered advisable to adopt rules to govern the size, appearance and location of signs, so as to bring the signs into some sort of uniformity and prevent one exhibitor's sign from interfering or shutting out the view of signs in the adjoining exhibits.

Signs, banners, etc., containing advertisements thereon, will not be allowed, except upon space of exhibitors to whom they belong,

and no exhibitor will be permitted to display advertising signs or decorations beyond the line of his exhibit.

Signs shall not exceed 2 feet in height.

Signs of oil cloth with brown flock ground and gilt letters are recommended.

Lower edge of signs in sections A, B, C, D, E, F, Gg, N, T, U, V, W, X and Y shall be 10 feet from floor line of the building.

Signs in sections G, H, I, J, K, L, M, M_2, shall be placed on the back line of the exhibitor's space, so that the top of the sign shall not extend over 1 foot above the floor line of the balcony.

Signs in sections O, P, R and S shall be fastened to the front of the balcony overhead.

In sections A, B, C, D, E and F, where signs placed at this height might interfere with view of exhibit, the sign may be so placed that lower edge shall be 16 feet from floor line of the building.

(7) Exhibitors may distribute catalogues, price lists, souvenirs, etc., only from their respectively allotted space.

FIG. 2.

Agricultural Building (day scene), Pan-American Exposition, at right of Electric Tower, Electric Tower Fountain Basin in foreground.

(8) No nails, tacks, or screws shall be placed or driven into the floor or walls, and all decorating or signs must be put up without defacing the building. Exhibitors will be held responsible for any damage to the floor, walls, or other parts of the building, caused by the act or negligence of the exhibitor or his agents.

A supplementary circular has also been issued stating that those who wish signs prepared for them can procure them prepared according to the rules of the committee at certain scheduled prices, also that railings, platforms, etc., to suit any sized space can be purchased, erected in place, the material to remain the property of the contractor, and that trucking can also be arranged for in advance in the same way. Arrangements for all of this work should be made with Marcus Nathan, director of exhibits, Grand Central Palace, New York.

The fact that all of the space available in the enormous Madison Square Garden has already been spoken for indicates that the exhibit feature of the convention will be most attractive, and will show the latest developments of American street railway practice.

REFUSE DESTRUCTORS IN COMBINATION WITH ELECTRIC POWER STATIONS.*

BY J. S. HIGHFIELD,

Electrical Engineer, St. Helens Corporation.

In writing this paper the author has found himself in a somewhat difficult position. He started off with the fixed idea that it was useless to deal with the subject without personal working experience of the plant of which he was writing, and from the results of working such plant. He endeavored to gain such knowledge so that he could write of plants other than the one for whose operation he is responsible, and so arrive at more general conclusions. He found, however, that the knowledge he could gain of other plants was exceedingly limited, and so he has kept to his original idea that nothing but personal working experience is of any use when writing on this subject, and at the risk of narrowing the issue, he decided to deal only with the plant whose working he controls and draw general conclusions to but a limited extent. He writes, however, with the hope that other engineers who have charge of similar plants will give the results of their experience.

It is absolutely certain that in most towns—in all but coast towns—there is no better method of getting rid of town refuse, gathered **from ashbins, markets, abattoirs, etc., than by cremation; and the primary object of every destructor must be to cremate the refuse in a perfectly sanitary manner. The temperatures attained in modern destructor furnaces worked with forced draught are always sufficiently high to insure that no fumes or foul gases come from the chimney; any smell that comes from a destructor is due to decaying matter, or to the heating of the refuse before it enters the furnace.**

The site for a destructor must be chosen so that the cartage is made through streets other than the main or residental streets, and also that the average distance to be traversed, from the point at which the refuse is collected, to the destructor is as short as possible. In towns having 100,000 inhabitants or more it will generally be more economical to have two sites, and in very large towns more than two sites, as any saving that can be made by burning all the refuse in one large central destructor is more than counterbalanced by the extra cost of carting. In St. Helens there are two destructors; the cost per ton of carting to No. 1 is 2s. 6½d., and to No. 2, 2s. 6½d.; if all the refuse were carted to No. 1 the cost per ton would be 2s. 11d. The policy of the committee responsible for the cremation of refuse must be decided very largely by this question of cartage, taking into account the value of refuse as fuel to produce steam for the power station, which value will be treated of later in the paper. In considering the question of site, where two or more destructors are necessary, and where no power station already exists, it is advisable to place the largest destructor on a site also suitable for the power station, and to choose this site so that the cartage shall not be very heavy from the districts where the refuse having the best fuel value is obtained. If a power station already exists and the site is sufficiently large and in a sufficiently favorable position from the cartage point of view, then, of course, this is the position for the refuse destructor.

Without the addition of boilers there are certain points that should obtain in any first-class destructor. These points may be tabulated:

1. Forced draught, preferably provided by a blowing engine as being more economical than a steam jet.
2. A suitable arrangement of duplicate flues, so that one set can be cleaned while the other set is working.
3. Charging appliances, so that the refuse can be quickly transferred from the carts to the furnace without unnecessary handling.
4. Baffling chambers or other devices to prevent dust entering the chimney stack.
5. Arrangements for quickly and cheaply removing the clinker.

If, in addition to the destruction of the refuse, steam raising on a serious scale is contemplated, it is further necessary to provide:—

1. A high-pressure boiler in connection with each furnace, of which there must be at least two, one as a stand-by.
2. Each furnace must have two divisions or cells, one of which must always be in full blast when the other is being clinkered or charged.
3. By-pass flues so that any surplus heat can be sent direct to the chimney.
4. Arrangements to prevent cold air getting to the boiler during charging and clinkering operations.
5. Duplicate flues to enable the furnaces to be worked continuously from week to week,

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*Paper read before the Incorporated Municipal Electrical Association of Great Britain at Glasgow June 19-22, 1901.

one set of flues being cooled down for the necessary periodical cleaning operations.

Generally when a destructor is used as an adjunct to an electric power station, a separate grate is provided so that the coal can be burnt under the boiler. This is only necessary when it is contemplated to steam the boilers without refuse, that is, with coal only, or when the refuse is of extremely variable quality. The writer has never yet used coal to help out the destructor fires, but occasionally the refuse is of poor quality, and then it is necessary to help the destructor with steam from other boilers. He has found it a good plan to burn the clinker and ashes from the electric works boilers in the destructor when the refuse consists largely of fish or paper; by this means he burns these substances in a better manner, and gets more steam and also gets rid of a waste product in an economical way.

Fig. 3.

Agricultural Building (night scene), Pan-American Exposition, at right of Electric Tower, Electric Tower Fountain Basin in foreground.

Referring to the details above mentioned, the most important, so far as steam production is concerned, is a rapid means of charging and clinkering the furnaces; with regard to the latter, some form of chain grate seems to promise the best station; with regard to the former, the sloping platform is exceedingly simple, but it involves much labor in raking the refuse into the furnace doors. The arrangement the writer is now using is one due chiefly to Alderman Foster, and consists of a platform on to which the carts are tipped, and which can be tilted to an angle of of about 45 degrees by means of winding tackle operated by an electric motor. The refuse slides or is easily raked over the charging doors and against a screen; the doors can be racked open, and the refuse falls and is raked into the furnace. This gear works well, and enables more refuse to be burnt in the same furnace than could be done by the former method. The flue, as above mentioned, must be duplicated or arranged so that the furnaces need never be shut down, and the forced draught arrangements should also be duplicated; in short, all the usual arrangements made by engineers to obviate a shut-down at the power station must be made in connection with any destructor designed to supply steam to its engines.

Having noted the above general considerations, it is necessary to consider the conditions of steam production from a destructor, and the first point is that the steam is produced steadily for at least 16 hours, and possibly for 24 hours each day. It is not in any way desirable to operate the destructor to follow, for instance, the variations of a lighting load; if a lighting load only is to be worked, and the day load is small, the use of a destructor is limited to the working of only a small part of the load. In the case of a direct current plant, a large storage battery is a most useful adjunct in this respect as in others; it enables the plant load factor, and hence the utilization of the steam, to be greatly improved. If a lighting station only is to be supplied, the remarks above as to the addition of an extra grate for burning coal do not apply. The correct way to design the destructor in such a case is to erect a boiler considerably too large for the destructor to steam alone to its full capacity; when the heavy load comes on coal may be burnt in the second furnace to drive the boiler to its full capacity. The writer regards such an arrangement, however, as only suitable for small installations; in such cases it would be very useful. If, however, the steam is used in connection with a traction station, or a station which supplies energy for both lighting and traction, then the destructor steam can be put to very much better use.

The plant of which the writer has charge consists of two Beamen and Deas' furnaces, each divided into two cells, each furnace serving to steam, to its full capacity, a Babcock boiler with 1,470 sq. ft. of heating surface. The forced draught is provided by an 18 hp. motor-driven fan, the average pressure in the closed ash pits being 3 in. on the water gauge. The plant at the power station consists of five steam generators of a total output of 1,000 kw. In addition to the steam from the destructor boilers, steam is supplied from a battery of four 30 ft. by 8 ft. Lancashire boilers. The steam ranges are designed so that two steam sets, each of 125 kw. capacity, can be run from the destructor independently of the other boilers, or the destructor boilers and Lancashire boilers can supply the whole range in parallel; in each machine circuit, a watt-hour recording meter is fixed to meter the output from the generator. The usual practice is to drive one or both of the 125 kw. sets from the destructors only, for a part of the day, and later on when more plant is required, to parallel both sets of boilers on the whole load. The working this year has been somewhat interfered with from the usual causes incident to any new installation; a considerable amount of alteration and reconstruction has been done, which has prevented the fullest efficiency of working being attained; the figures given below show the results of the first year's working of a new plant, and give a fair idea of the actual value of a small destructor plant in a town where the refuse has a good calorific value. It was found that the calorific value of the fuel was distinctly better in the summer than in the winter. The refuse varies somewhat from day to day, and, therefore, if no other boilers were available, it would be necessary occasionally to use coal under the destructor boilers, or to hold a reserve of boiler ashes and clinker to use when the calorific value of the refuse was poor.

The figures relating to 12 months' working from March 31, 1900, to March 31, 1901, are as follows:—

Figures for one year's working of a two-furnace Refuse Destructor.

	Total for year.	Average per week.
Weight of refuse burnt.	9,778 tons.	188 tons.
Electric energy used to drive fan and other motors.	70,000 units	1,346 units.
Units generated by steam..... ..	365,000 "	7,019 "
Wages on burning.....	£750	£14 8s. 6d.
Wages on repairs	86	1 13 1
Total wages..	836	16 1 7
Weight of clinker produced ...	3,900 tons	75 tons.
Value of mortar sold	£221 9s. 8d.	£4 5s. 2d.
Value of electric units generated at .3d. per unit generated......	450	8 13 1

Averages per ton of Refuse Burnt.

Units generated	37.3
Units used on work	3 1
Cost of burning, including wages, light and power....	22.1d.
Cost of repairs (wages and stores)	3.0d.
Total cost of destruction	25.1d.
Cost of removing clinker not otherwise used	5.5d.
Total cost of destroying refuse and removing part clinker.	30.6d.

From the above figures, it will be seen the net saving to the destructor department due to combining the electric works and the destructor works is £450, less £50 on boiler repairs, and less the interest and sinking fund charges on £1,500 (which represents the extra capital cost on the boiler plant above what would have been necessary for smaller boiler plant for working the mortar mills, the blowing fan and other plant on the works), which may be taken as £90, leaving £310, or 41 per cent. of the total wage bill. The cost of cremating the refuse and removing the clinker is therefore reduced from 2s. 6.6d. per ton to 1s. 11d. per ton.

It should be noted here, that in addition to supplying steam to the electric works, the destructor also supplies steam to drive two mortar mills and a steam winch. Considerable care was taken to prevent dust from the destructor getting into the power station; it is almost impossible to do this quite successfully, but no serious harm was done by the small amount that did enter. In conclusion, the writer would say that in certain cases where a suitable site for destructor and electric works exists, and where the works are not very large, the combination can be usefully made, when a traction or other good all-day load exists. For a very large works, or for a station which only drives a lighting load, there are not many instances where there is any economical value in the combination. Without desiring to generalize, the writer thinks that in these cases it is better to use the destructor furnaces to provide steam for driving mortar mills or other machinery, on which the calls are not so exacting as on an electric power plant.

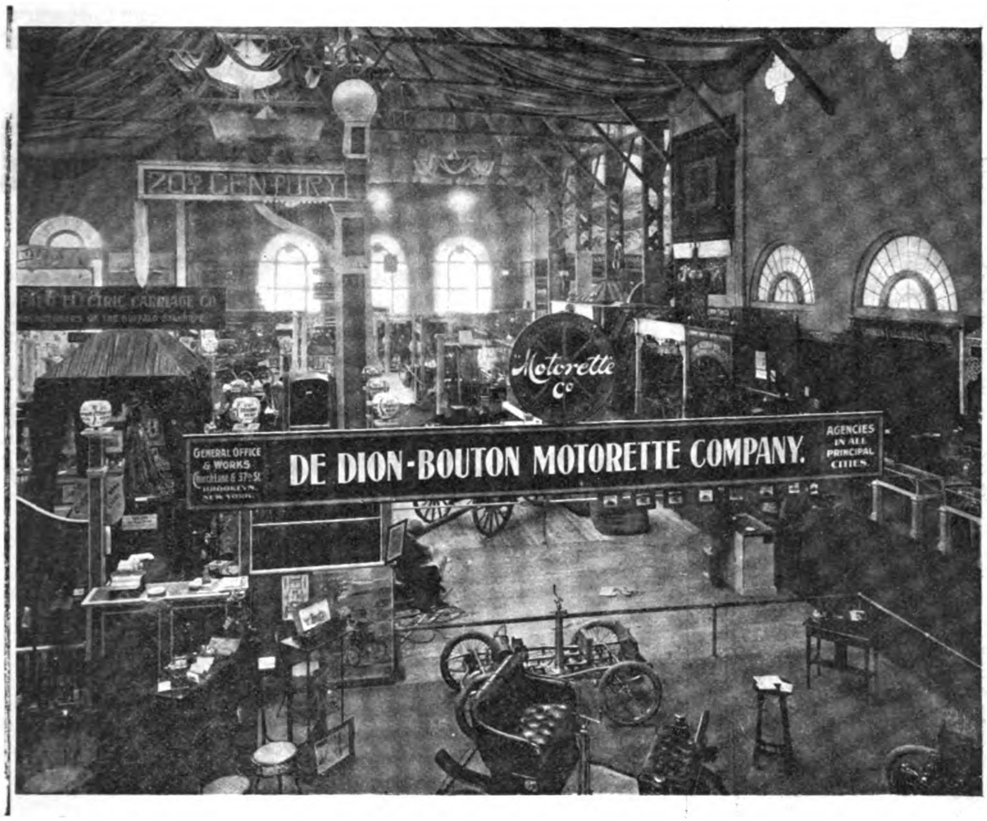
20th CENTURY
Motorette Co
GENERAL OFFICE & WORKS
DE DION-BOUTON MOTORETTE COMPANY.
AGENCIES IN ALL PRINCIPAL CITIES

FIG. 4.
Exhibits in interior of Machinery Building, Pan-American Exposition.

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THE PROGRESS OF INDEPENDENT TELEPHONY.*

BY E. H. ANDRESS.

Having listened to two very interesting papers already this afternoon, and on account of the excessive heat in this room, I will ask you to excuse me from reading the paper I have prepared on the subject, "Progress in Independent Telephony," which was assigned me on the programme.

Judge Walker, in his admirable paper of yesterday, gave you the greater part of the statistical part of the wonderful progress made in the independent field. All the papers read and talks made bore strongly on this subject, and if you will permit me I will simply give you a short talk on the pioneer work done in the telephone field.

Our benefactors, when they first came into these forests to make themselves a home and build up a new civilization, underwent great dangers and endured great hardships. They were continually surrounded and harrassed by wild Indians and wild animals, but I doubt much whether they suffered any greater dangers or had to put up with any more exasperating annoyances than did the telephone pioneers. No Indians could have devised any meaner tricks or hindrances than did the Bell Telephone Company. No wild animals could have growled and snarled any more tenaciously than did the hired emissaries of the great monopoly of the Bell interests.

They went to the proposed stockholders of our companies, and, under the pretended garb of friendship, told them that if they would put their money into the telephone business they would lose every cent, and they would be prosecuted to the bitter end in the United States courts. They went to the subscribers for telephones and told them that they laid themselves liable, as well as the company, and they kept this up day by day, thinking they would intimidate them and get them to throw up the sponge. But they reckoned without their host. The people had gotten tired of the greed and avarice of this monstrous monopoly. They had received miserable service, and at extortionate rates, and would stand it no longer.

Through the loyalty and friendship of the people they made the independent movement a success. When they found they could not scare the people out, and when the plant was ready for operation and did start, they came out with a loud proclamation, and reduced the rates of residence 'phones to $2.50, where they had been $3, and from $4.50 to as high as several dollars.

This had no effect upon our patrons, and we kept on in the even tenor of our ways, and kept adding new customers every month. We started in, on January 1, 1895, with 300 subscribers. The plant has steadily grown and we now have over 1,500 telephones in every-day use. Parties starting in now have a much easier task than did we pioneers. We had scarcely more than two or three places to get material. Our first outfit from start to finish was very crude. I will give you a partial description of it. For fear I might make some mistake or misstatement, I have jotted a few points, and will read them to you. First, our switchboard.

Tin shutters. Rusty iron plunger rod to kick down the shutter. Cotton-covered wire on drop coils—all wiring done with cotton covered wire. Jacks made of iron castings and pewter springs. Plugs, metal and rubber, poorly put together. No protection. Home-made distributing board.

Cheap, indifferent generator, always in series upon line. Manual switchhook pulled down by hand and held by a ratchet. Transmitter made of a thin shingle with a knife carbon glued horizontally. Three carbon fingers hanging perpendicular laying against knife blade. Could not use when any vibration in building.

Receivers the shape of a bar of Babbitt's soap—diaphragm the same shape. Opposite poles of permanent magnet three inches apart, interval action always present. Lay the side of the receiver to the side of the ear. All punk.

This may sound very crude to you, but such was our first outfit; poor material and faulty workmanship. How different now. You who were fortunate enough to visit the Sterling Electric Company's plant this morning saw a different state of affairs, and what was possible now.

Outside of poles, cross arms, pins and wire, you can get everything and anything necessary for all up-to-date telephone plants right there, and you need have no fears of suits for infringements. The head of that plant was for a long time the inventive genius of the Bell Telephone Company, and, getting tired of their manner of doing business, took his patents and went it on his own account, and the Sterling Electric Company is the result.

As I said before, all the papers read in your presence have given you statistics showing the wonderful growth of the independent telephone movement, and I will not detain you by a repetition of them. It may be that the Bell Telephone Company do not feel the effects of our wonderful strides and are not hurt, but they remind me of an Irishman who had an accident on a railroad while unloading ties. They were on a hill of about twenty-five or thirty feet and were unloading from a car. The ties were covered with ice and one giving way rather suddenly carried the Irishman with it down the embankment, rolling over and over. The one remaining on the cart cried down to him, "Mike, are you hurted?" The answer came back, "No, I don't believe I am hurted, but I believe my damn back is broke." So I believe it is with the Bell people. They try and make themselves believe that our efforts and success have not hurt them, but I believe they are like the Irishman.

I want to say a word for the Indiana Mutual Telephone Association. I was its first president, and continued in office until last year. I well know the struggles we had in its first organization. This meeting to-day is in grand contrast to that of our first meetings. It has kept in pace with this grand progress, and I would like to see every independent telephone plant in the state of Indiana a member of this organization. It can and will do them good. Through it differences can be amicably settled, information obtained and scattered throughout the State, and the officers helped in the discharge of their duties. "In union there is strength," and if we all pull together I have no fears for the future.

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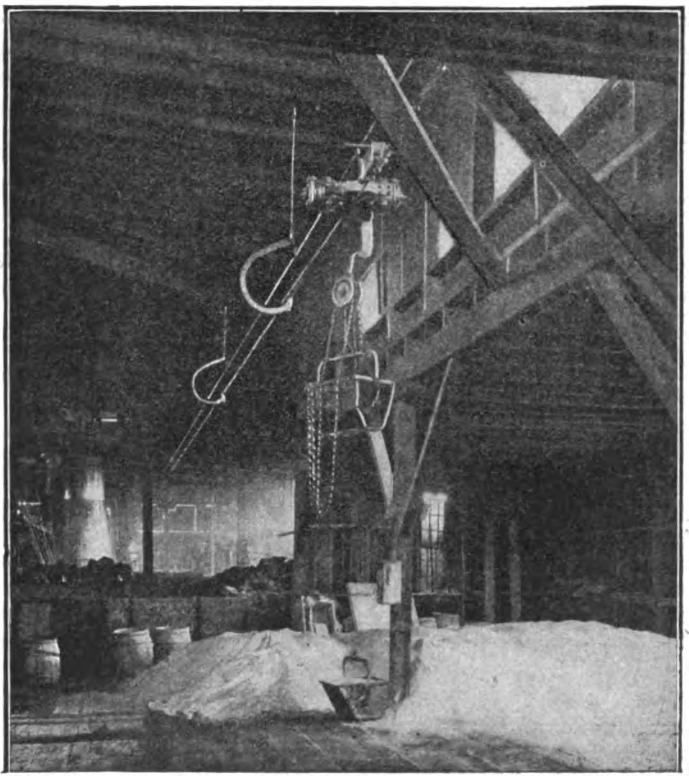
*Paper read before the Annual Convention of the Indiana Mutual Telephone Asssociation, held at Lafayette, July 29-30, 1901.

THE TELPHERAGE SYSTEM.

Telpherage is the automatic transportation of material by electricity, either overhead, designated as aerial telpherage; upon the surface, called surface telpherage; and underground, or tubular dispatch telpherage. There is a fourth class, formerly known as tramrail telpherage, but this is now included under aerial telpherage.



View of Telpherage System.

Telpherage, according to Prof. Fleeming Jenkin, who invented the word, is the "transmission of vehicles by electricity to a distance independently of control from the vehicle." The word is derived from two Greek words, meaning far-carrying, the first syllable being the same as that in the words telephone and telegraph. A telpher is an electric car used for telphering or automatically carrying goods or other material. The telpherage idea is old, yet new; old, as the electric railway was old, before the advent of the Sprague system in 1887, yet new at present, as that system was new in 1887.

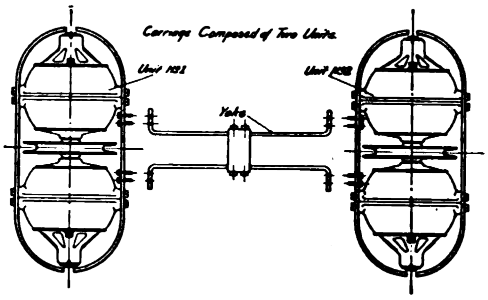
As much of the original work in telpherage was devoted to overhead cableways, the meaning came gradually to be restricted to electric aerial transportation, but is now generally restored to its original meaning and applies not only to cableways, but to electric automatic transportation, whether overhead, surface or underground. Telpherage has, however, its own peculiar field, and this was clearly expressed by Prof. John Perry, the Professor of Mechanical Engineering and Applied Mathematics of the City and Guilds of London Technical College, who, with Prof. W. E. Ayrton, the Professor of Technical Physics, has devoted much time in the past to the scientific and commercial development of telpherage. In a lecture delivered by Prof. Perry he shows the great possibilities of telpherage, and states that "the commercial success of telpherage depends upon the conveying of light loads and the subdivision of material." Telpherage is not, therefore, a competitor of existing railways for passengers or for bulky or heavy freight. Another authority says "the crowds handled by the street railway companies on holiday occasions, which far exceed the capacity of a double-track railway as ordinarily operated, seems remarkable. But the condition of an electric road is that of a large number of small units following each other in quick succession and at a uniform speed." It is upon this principle that telpherage lines are operated, and the results are most remarkable.

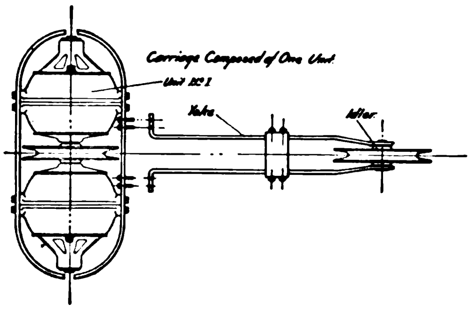
As to aerial cableways and the commercial, practical use of wire cables for suspended cars, there are at present some 25 manufacturers furnishing mechanical cableways, and one manufacturer alone has more than a thousand lines in operation, some of which are twenty miles in length. Most of these are operated on the system of using one cable for the track, the carriers being drawn by another cable. The disadvantages of these systems are the necessity of having devices for handling the long moving cables, the friction entailed by using such devices, the necessity of having relay stations at intervals of 2 or 3 miles, and the expense of maintenance and repairs which necessarily occur under such conditions. This mechanical system, however, demonstrates the claim that even with such drawbacks the total operating expenses per ton-mile are less than by any other method of light transportation.

It is evident that with the telpherage system rivers, ravines, swamps and inequalities of the ground offer no obstacle to direct transportation. It is equally well adapted for use over level plains, where no such difficulties present themselves.

The size of the cable varies according to the loads to be carried. The operation is free from surface obstructions, such as snow, washouts or wrecks. The rapidity of operation, which depends on the speed of the electric car, is only limited within reason by the cost of construction. The length of the line from each station is bounded only by the commercial possibilities of electrical transmission.

The telpher, or automatic truck which runs along the upper side of the taut wire cable, consists of four small slow-speed direct current motors, two directly coupled upon each of the two shafts, upon which also are mounted grooved wheels which run upon the top of the cable. The load is suspended below in the method shown by the illustrations.





From the middle of the apparatus rises a short trolley, making contact by means of a roller so as to allow considerable variation in the position of the trolley wire. The latter is suspended directly above the running cable. The operation of the system is entirely automatic. The current is turned on at one end when it is desired to start the telper, which accelerates itself gradually up to its full speed—generally about 12 miles an hour—slowing down automatically for curves and automatically switching off the current so as to stop at the desired place at the other end of the line.

One of the chief characteristics of the aerial system of the United Telpherage Company is that it is called the unit system. After making many trials and experimenting with various methods this was selected as the most flexible, and one which most successfully fulfilled the greatest number of conditions. This was the result of practical demonstration. In the cut as given above is shown what is termed a unit. This consists of the combination with a suspended car of a shaft rigidly fixed to the supporting wheels and electric motors on each side of the wheels having their revolving armatures fixed rigidly on the shaft. These motors are combined with a frame which connects them together. A unit combined with the yoke, as shown in the second figure of the cut, including a trailing wheel, constitutes a telpher truck and is termed a single-unit telpher. As shown in the first figure of the cut is a double unit, and consists of two units combined by the yoke and is termed a double-unit telpher.

It will be noticed that in this system there is no necessity for gearing. All fixed speed reduction, instead of being accomplished by gears, is effected by varying the size of the driving wheel of the unit. There is a saving at certain speeds of over 20 per cent. in the power required, especially in the smaller size motors.

The motor is iron-clad; water-proof; all switch devices completely inclosed.

Barrel in Transit.

The motors are accessible and the armatures can be removed without dismounting the motors.

There being no gear to rattle, the operation is practically noiseless.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended August 22:

Antwerp, 323 packages, $4,002; Argentine Republic, 143 cases, $4,250; Arnheim, 1 case motor vehicles, $130; Brazil, 126 packages, $1,776; Berlin, 25 packages, $275; Bremen, 18 packages, $569; Bristol, 1 package, $50; British Guiana, 6 packages, $345; British East Indies, 3 packages, $59; British West Indies, 43 packages, $357; British Possessions in Africa, 41 cases, $2,926; Brussels, 12 cases, $600; Central America, 34 packages, $455; 1 roll cable, $700; Chili, 10 packages, $734; Cuba, 148 cases, $6,654; Dutch West Indies; 2 cases, $22; Florence, 1 package, $100; Genoa, 3 packages, $100; Glasgow, 95 packages, $18,452; 2 rolls electrical cables, $1,016; 12.500 pieces electrical conduit, $6,000; Hamburg, 37 packages, $2,590; Havre, 10 packages, $295; 1 motor vehicle, $400; Haarlem, 1 package, $136; Hayti, 1 package, $40; Leicester, 3 cases, $120; Liverpool, 215 packages, $22,418; London, 332 packages, $14.179; 13 cases auto vehicles, $2,480; Malta, 1 case, $23; Manchester, 9 cases, $2,576; Marseilles, 2 packages, $134; Mexico, 82 packages, $1,538; Milan, 2 cases, $30; New Castle, 1 case, $50; Peru, 4 packages, $129; Rome, 1 package, $100; Southampton, 137 packages, $3.954; 7 cases auto vehicles, $350; Stettin, 4 packages, $435; Uruguay, 1 package, $42; U. S. Colombia, 2 packages, $39; 178 cases, $4,565; Venezuela, 19 cases, $502.

Annual Meeting of the American Institute of Electrical Engineers.

The Eighteenth Annual Convention of the American Institute of Electrical Engineers held its first session in the New York State Building, Pan-American Exposition, Buffalo, at 11 A. M. on Tuesday, August 20.

The attendance was unusually large and six distinguished gentlemen were present from Paris as follows: Prof. P. Janet, R. R. Courbier, M. Maurice Aubert, M. Marcel Aubert, M. Debeaure and M. Roux.

M. Gillon, who was sent by the Belgium Government on a mission to inspect American electric railway system, occupied a seat at the meeting, as did Louis T. Grant, vice-president and general manager of the Hawaiian Automobile Company of Honolulu.

The meeting was called to order by Charles P. Steinmetz, the president of the American Institute. George F. Sever, superintendent of electricity at the Pan-American Exposition, formally welcomed the guests to Buffalo. President Steinmetz responded feelingly, and the work of arranging the programme for the rest of the week was taken up.

The afternoon was spent at the Falls, the guests taking a special car at the West Amherst gate. The trip was purely for pleasure.

Wednesday, August 21.

President Steinmetz called the meeting to order at 10 o'clock.

Paul M. Lincoln read his paper on "Synchronism and Frequency Indication." It was decided not to discuss each paper read, but to read all on the allied topics of meters and indicators. Caryl D. Haskins then read his paper entitled "Some Fundamentals of Electric Meters." This was a discussion of the relation between torque friction aging and the surroundings of the meter, these being the essential elements which meter engineers must consider. Harry P. Davis presented an interesting paper entitled "Metering of Electrical Energy." It dealt with the mechanical and operative details of motor meters.

W. H. Browne, Jr, read his paper on "Power Factor Indicators." Mr. Browne's paper was mathematical and interesting.

A long discussion then took place that was participated in by Messrs. Barstow, Steinmetz, Haskins, Breck, Mershon, Scott and Dunn.

Thursday, August 22.

The members assembled in the convention hall early, and were called to order at 10:30 by the President.

Prof. William S. Aldrich, of the University of Illinois, read a paper giving the performance of an artificial forty-mile transmission line from experiments made by him and George W. Redfield at that university.

F. A. C. Perrine read a paper on "Elements of Design Particularly Pertaining to Long-Distance Transmission."

Charles F. Scott read a paper on "The Induction Motor and the Rotary Converter and Their Relation to the Transmission System." In comparing synchronous and induction motors, he said that "the latter is generally favored except in large sizes. The rotary converter has also come into very wide use, being cheaper than the motor generator, and in several respects preferable."

President Steinmetz read a paper on "Theoretical Investigation of Some Oscillations of Extremely High Potential in Alternating High Potential Transmissions," in which he gave a section of a series of experiments extending over several years. This paper of 23 pages was a mathematical investigation with many equations in calculus.

In the absence of E. W. Rice, Jr., his paper on "The Control of High Potential Systems of Large Power" was read by Mr. Steinmetz. Mr. Rice described the oil-break switch invented by him and now in use at the Metropolitan Railway station in New York to control the high power currents used there.

Friday, August 23.

A large attendance of members greeted the President when he called the meeting to order.

Lewis P. Stillwell presented a very exhaustive account of the electric transmission of power from Niagara Falls. "The Niagara plant," said Mr. Stillwell, "has contributed in no small degree to the development of a considerable number of important chemical industries, and is already the center of a prosperous and rapidly growing manufacturing community."

Alexander J. Wurts followed with his paper on "Development of the Nernst Lamp in America." He said: "The original Nernst lamp was too easily put out of order. The quality of this light is remarkable for its beauty and close approximation to daylight. All colors are seen in their proper shade. No shadow is cast; the light is steady, the lamp simple, cheaply maintained and highly efficient and operative on 3,000 alternations. It differs from the ordinary incandescent lamp in that the current is passed through a glower made from a dough of the rare earths mixed with a suitable binding material, cutting the porcelain-like string into convenient lengths, drying, roasting and finally attaching lead wires. When cold it is a non-conductor; hence it must be heated at the start. No inclosing bulb is required. The lamp has a life of about 800 hours, and unlike the filament-incandescent lamp, it maintains its brightness and even slightly improves with age." Mr. Wurts maintains that the Nernst lamp has passed the experimental stage.

Abstracts of papers on the "Supplying of Power from Large and Small Cities," prepared by L. A. Ferguson, William Lispenard Robb and others engaged the attention of the members for the balance of the afternoon.

Saturday, August 24.

The attendance of members was not so large on Saturday, and after the reading of papers on "Notes on Modern Electric Railway Practice," by Albert H. Armstrong, and "Electric Railway Apparatus," by Ernest J. Berg, the Convention adjourned.

To Visiting G. A. R. Members and Their Friends.

We wish to extend a very urgent invitation to the members of the Grand Army of the Republic and their friends who may be interested in the telephone business, and who intend to visit Cleveland during the Grand Army encampment on September 9, to make our offices on the second floor of the Electric Building their headquarters.

We will take pleasure in taking care of their mail, furnishing them all the information in our power and making their visit agreeable in every way.

Consolidated Telephone Co.
Inter Ocean Telephone & Telegraph Co.
Century Telephone Construction Co.
Cleveland, O., Aug. 28.

Latest Announcement about the Municipal Electricians' Convention.

The following has been received from F. C. Mason, referring to the coming meeting of the International Association of Municipal Electricians:

I am pleased to announce that arrangements have been completed whereby members and friends of the Association can secure passage to Niagara Falls and return from New York with the privilege to stop over at Buffalo at the following reduced rates: Day coach excursion, not good on Pullman or sleeping cars, good for five days, including day of purchase. Train leaves Erie Railway foot of Chambers street, New York, 9 A. M., Saturday, August 31, arriving at Niagara Falls at 9 P. M., same day, $9.

Tickets good for fifteen days, and good on Pullman or sleeping cars, $13. Train leaves Erie Railway foot of Chambers street, 7:30 P. M., Sunday, September 1, arriving at Niagara Falls, Monday, September 2, at 8:08 A. M.

Those who prefer to go via New York Central and Hudson River R. R., can secure tickets good for fifteen days for $14.75, good on any train except the "Empire State Express" and the "Lake Shore Limited," also, for $17, tickets good on all trains up to December 1.

These are the best rates now procurable, there is a possibility, however, of this being reduced. If it is done we will secure the benefit.

The majority of our members and friends will leave Sunday night, September 1, on the 7:30 train via Erie Railroad, foot of Chambers street, or 7:30 P.M. train via New York Central, 42d street depot, same day.

Kindly inform me immediately which route you will take and how many you will have in your party, also what sleeping car accommodations you desire. I will have a representative of the Association, also of the railway company, meet you at either of the above stations you may select, prepared to furnish you with railroad and sleeping car tickets, and other information one hour before the train leaves, or 6:30 P.M.

Kindly furnish me with information asked for without delay. You can estimate the number you expect to have in your party.

Pullman sleeping car, $2 each way.

After adjournment of the Convention, those who visit Buffalo, will find Statler's Hotel, $2 and $2.50 per day, American plan, a satisfactory stopping place, only one block from main entrance of Exposition; write E. M. Statler, proprietor, for rooms and information.

Be sure and have the lady members of your family join you in this our Sixth Annual Convention; arrangements have been made for their entertainment.

Proposals Invited.

The War Department, through the United States Engineers' Office, is inviting sealed proposals until September 19, for furnishing and installing an electric light plant at Fort Washington, Md. Specifications and detailed information will be furnished intending bidders upon application to Lieut. Col. Chas. J. Allen, Washington, D. C.

To Make Batteries—$1,000,000 Capital.

The Consolidated Battery Company of New York City was incorporated at Albany, on the 22d inst., with a capital of $1,000,000, to manufacture and deal in electrical machinery, batteries, instruments and appliances. The directors are Daniel C. Knowlton, Arthur A. Mosher and William C. Nicholas, of New York City.

The New Storage Battery Company of Boston was chartered at Dover, Del., on Thursday last to manufacture the Redding New Storage Battery. Incorporators: Jerome Redding and I. W. Deering of Boston, L. D. Lathrop of Gloucester, Mass., and Gardner W. Kimball of this city.

Great Demand for Flexible Conduits.

The Sprague Electric Company has been obliged to run the New York factory at night for some time to meet the demand for its flexible conduits for interior wiring. The new flexible products are very popular and will continue the reputation for superiority that the Sprague Company's conduits always have enjoyed. The superior qualities of the Greenfield Flexible Steel Armored Conductors and cords are simplicity of installation, thorough protection of wire and insulation from mechanical and other injury, and high grade insulation at low cost.

COMING ELECTRICAL EVENTS

American Street Railway Association—Convention, New York City, October 9, 10 and 11.

American Electro-Therapeutic Association—Buffalo, N. Y., September 24, 25 and 26.

Association of the Edison Illuminating Companies—Meeting, September 10.

International Association of Municipal Electricians—Convention, Niagara Falls, September 2, 3 and 4.

Old-Time Telegraphers' Association and U. S. Military Telegraph Corps—Convention, Montreal, September 11, 12 and 13.

Pennsylvania State Street Railway Association—Convention, York, Pa., September 4.

Roentgen Society of the United States—Meeting, Buffalo, N. Y., September 10 and 11.

INCORPORATIONS.

The Illinois River Electric Railway Company, Aurora, Ill. Capital stock, $150,000.

The Hall Electric & Manufacturing Company, Chicago, Ill. Capital stock, $50,000, Incorporators: Samuel L. Crim, Orsepheus A. Harding and Frederick E. Koehler.

The Swan Electric Manufacturing Company New York City. Capital stock, $250,000. Directors: W. J. Swan, W. J. Berg and H. A. Metz, New York City.

The American X-Ray Company, Chicago, Ill.—to manufacture electrical machines. Capital stock, $100,000. Incorporators: W. W. Gemmill, C. M. Foll and M. E. Barnhard.

The Telescope Company, New York City—to construct electrical plants. Capital stock, $100,000. Directors: H. L. Sellers, R. H. Sellers and M. S. McKain, all of New York City.

The Charleston and Kanawha Valley Power & Railway Company, Charleston, W. Va. Capital stock, $500,000. Incorporators: Thomas J. Carmack, Charleston; Howard T. Goodwin, John W. Coburn, C. M. Coburn, Philadelphia, Pa., and D. R. Sutton, Wilmington, Del.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUGUST 20, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

680,704. Electric-Traction Road. Leon Dion, Boston, Mass., assignor to the Electrical Safety Traction Company of West Virginia. Filed Nov. 24, 1900.

680,824. Contact Device for Electric Railways. George Westinghouse, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company, same place. Filed Feb. 28, 1896.

680,901. Signaling Device for Cars. William W. Ward and John Kean, Fairmont, Minn. Filed May 15, 1901.

680,919. Trolley-Guide. George F. Heussner, Portland, Ore. Filed Dec. 13, 1900.

680,955. Car-Fender. Jefferson D. Wintz, New Orleans, La., assignor of one-half to David G. Baldwin, same place. Filed May 7, 1901.

681,030. Railway Signaling. Frank McBrien, Newark, N. J., assignor to the Union Switch & Signal Company, Swissvale, Pa. Filed Dec. 3, 1900.

681,039. Electric Railway. William Chapman, Washington, D. C., assignor to the Electro-Magnetic Traction Company of West Virginia. Filed May 29, 1896.

681,119. Trolley-Switch. Walter P. Hines, Portsmouth, Va., assignor of one half to Albert N. Palmer, Norfolk, Va. Filed Oct. 20, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

680,918. Incandescent-Electric Light Support. Harry Gilpatric, Springfield, Vt. Filed Dec. 27, 1900.

680,932. Incandescent-Lamp Socket. Norman Marshall, Newton, Mass. Original application filed Aug. 8, 1900. Divided and this application filed March 18, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

680,792. Alternating-Current Induction-Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed May 24, 1899.

680,793. Dynamo-Electric Generator. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed June 28, 1900.

680,797. Electromagnetic Motor or Reciprocating Engine. Ralph D. Mershon, New York City, assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Nov. 2, 1899.

680,798 Mechanism for Generating Variable Electromotive Force, James E. Miller, Edgewood Park, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed March 1, 1900.

680,981. Electric Switch. Montgomery H. Johnson, Utica, N. Y. Filed May 27, 1901.

681,002. Motor-Meter for Alternating Currents. Albert Peloux, Geneva, Switzerland, assignor to the Societe pour l'Exploitation de Compteurs Electriques, Rittener & Co., same place. Filed March 8, 1901.

681,112. Carbon Break for Electric Switches. Henry D'Olier, Jr., Philadelphia, Pa. Filed May 13, 1901.

681,133. Starting Apparatus for Electric Motors. Thomas S. Perkins, Idlewood, Pa. Original application filed Sept 28, 1893. Divided and this application filed June 19, 1901.

681,167. Electrical Controller Attachment. Guy L. Fairbrother and Albert H. Mathewson, Thompsonville, Conn.; said Fairbrother assignor to said Mathewson. Filed April 19, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

680,879. Telephone-Exchange Apparatus. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Filed Dec. 26, 1899.

680,880. Connection-Register for Telephone-Exchanges. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Filed Dec. 26, 1899.

680,881. Selective Calling-Key for Party-Lines. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Filed Jan. 6, 1900.

680,890. Connection-Counter for Telephone-Exchanges. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 26, 1899.

MISCELLANEOUS.

680,698. Printing Telegraph. John Burry, Fort Lee, N. J. Filed April 18, 1900.

680,795. Strap-Coil for Electrical Machines. John P. Mallett, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Oct. 17, 1899.

680,804, Electrically-Propelled Vehicle. Frederick J. Newman and Joseph Ledwinka, Chicago, Ill., assignors to the Hub Motor Company of New Jersey. Filed Jan. 18, 1901.

680,809. System of Electric Lighting on Constant-Current Circuits. Henry N, Potter, Halensee, Germany, assignor to George Westinghouse, Pittsburg, Pa. Filed Oct. 3, 1900.

680,819. Copper Alloy. Bertrand S. Summers, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 4, 1899.

680,968. Electric Fuse or Cut-Out. Louis W. Downes, Providence, R. I. Filed May 2, 1901.

680,988. Magnetic Speed-Indicator. Simon B. Storer, Syracuse, N. Y. Filed March 14, 1000.

681,099. Method by which Several Telegraphic Messages Can be Transmitted at the Same Time Through One Conductor or by Wireless Telegraphy. Anders Bull, Cologne, Germany. Filed May 8, 1900. Renewed July 1, 1901.

681,107. Electric Furnace. Alfred H. Cowles, Cleveland, O., assignor to the Electric Smelting & Aluminum Company, same place. Original application filed July 20, 1895. Divided and this application filed Nov. 24, 1899. Renewed July 22, 1901.

681,158. Conduit. Charles A. Warner, Philadelphia, Pa., Filed July 6, 1901.

THE TELEPHONE WORLD.

Another Big Company in Chicago.

All arrangements for the entrance of the Illinois Telephone & Telegraph Company, a corporation independent of the Chicago Telephone Company, into the Chicago field have been made. The company has filed a trust deed under a mortgage to secure a bond issue of $5,000,000. Much of the money to be derived from the issue will be used to establish a big plant in Chicago. It is understood that already $3,000,000 of the bonds have been sold through J. B. Russell & Co. of Wilkes-Barre, Pa. The other $2,000,000 will be held in the treasury for future development of the system. The entire capital stock—$5,000,000—will be deposited under a voting trust agreement for a period of two years. A. G. Wheeler, president of the company, said upon the subject: "The work of installing the plant will be pushed vigorously from this time, in order that we may establish our telephone service at the earliest possible date. We are endeavoring to complete the plant so as to have 15,000 telephones in the downtown district by next spring." The Illinois Telephone & Telegraph Company was organized to compete with the Chicago Telephone Company, which now enjoys what is generally regarded as a monopoly. The new company will introduce what it claims is a more up-to date instrument, a better service and a lower rate than that granted by the Chicago Company.

The stockholders of the Marathon County, Wis., Telephone Company will not hamper the plans of those who have the project for the consolidation of the valley telephone lines in hand by one dissenting vote. The company has now decided to enter the valley combination, and by the passage of the following resolution, authorized the sale of the stock of the company to the Wisconsin Valley Telephone Company by the directors: "That the board of directors be authorized to make such sale of the lines of this company, on a just and equitable basis, the price of said stock not to be sold for less than par value of such stock, leaving the stockholders the right of option to accept for stock either cash at the agreed price or stock in the consolidated company, as each might prefer."

Some of the farmers of Clyde, N. Y., following the example set by their brethren in the West, are building telephone lines of their own. They are thus enabled to sit at home and at the same time, in a sense, "go visiting" among their neighbors. Over twenty farmers living northeast and northwest of Savannah, N. Y., banded together, cut and set poles, strung wires and put in instruments. The farmers are greatly pleased with their enterprise.

Articles of incorporation of the Home Telephone Company of Papillion, Neb., have been recorded in the office of the Secretary of State. The company is capitalized for $50,000, and the principal holders are Isaac D. Clark, J. M. Elwell and C. J. Calhoun. It is asserted that this company will construct an independent telephone system in Papillion with long-distance lines to other exchanges already established in Sarpy County.

The Winona, Minn., Telephone Company has been granted permission to establish and maintain toll stations in the city of Rochester, and work on this extension will begin at once. For some time the Bell Company has had a monopoly there, and this competition will now have the effect of bringing down the rates.

Suit for $100,000 damages has been brought by the Stromberg-Carlson Telephone Manufacturing Company against the Kellogg Switchboard & Supply Company. The plaintiff charges that its business has been injured by misrepresentations on the part of the defendant.

The contract for building a telephone line from Hempstead, Tex., to Prairie View State Normal and Industrial College, six miles, was awarded to C. A. Horton of Austin, and work will begin as soon as the material arrives.

The Delaware and Atlantic Telegraph & Telephone Company has commenced extensive improvements to its system in Media, Pa. The present mode is to be displaced and the common battery system, similar to the system in vogue in Philadelphia, is to be inaugurated.

The Cresson, Pa., Telephone Company has bought the stock and franchises of the Northern Cambria Telephone Company, operating lines at Nicktown, Spangles, Barnesboro, Hastings and Patton. The Cresson Company now connects with Altoona and Johnstown.

Frederick P. Fish, of Boston, president of the American Telephone & Telegraph Company, has been elected a director of the Chicago Telephone Company, succeeding the late Alexander Cochrane.

An Independent System for Cincinnati.

Officials high in the confidence of H. A. Everett and E. W. Moore say that the syndicate will place an independent telephone system in Cincinnati in the near future, and that entrance would not be gained by a purchase of the control of the Bell Company, that now holds undisputed sway in the Queen City. It is to be surmised that either some old franchise is to be purchased or a new grant is to be secured in some way.

The situation as regards telephones is more than unique in Cincinnati. The city is the center of a circle whose radius is 900 miles. With one exception there is no other city within that circle that does not enjoy or is not about to enjoy the service of two telephone systems. The exception is Chicago.

In Cincinnati there are at present 10,000 telephones in service. By Cincinnati is meant the district about the city, including service across the river and in the vicinity. In Cleveland, a city relatively the same size, there are 22,000 telephones, while in Columbus, much smaller than Cincinnati, there are almost as many telephones, 8,000.

Conferences between the principals close in touch with Everett and Moore are being held three times a week. At each of these meetings the Cincinnati and Hamilton problem is the principal subject of conversation. A conference was held recently and the matter was thoroughly gone over, it is said. Those interested would have nothing to say as to the result of the conference. It is said, however, that a plan of campaign was mapped out.

Henry Everett said that there was no deal on for the purchase of the Cincinnati Bell telephone system, but he said that as the independent lines were at the very threshold of the city they were very anxious to get inside.

American Telephone Stock.

A Boston official of the American Telephone & Telegraph Company says:

"The shares of the American Telephone Company will, without doubt, be traded in on the New York Stock Exchange within the next two weeks; to be more exact, probably September 3. The listing committee of the New York Exchange late in June recommended the listing of $15,000,000 4 per cent. collateral bonds of 1929, and $94,237,500 capital stock, but the stock has not been traded in owing to delays in the engraving of new securities made necessary for trading on the New York board. The listing committee also recommended the listing from time to time of $20,709,000 additional stock."

M. A. Meyer, of Chicago, president of the Strowger Automatic Telephone Exchange Company of America, has just returned from Berlin, Germany, after having completed, it is said, a contract with the German Government for the installation of the Strowger system throughout Germany. The negotiations just consummated are the result of 15 months' experiments with the Strowger system conducted by the imperial postoffice department. Ludwig Lowe & Co., a prominent Berlin firm of electrical contractors, has been ordered by the Government to install the Strowger instruments as fast as subscribed for. Contracts are said to be already on hand for nearly 10,000 connections.

The Niagara Falls Home Telephone Company, Limited, with a capital stock of $40,000, has been incorporated in Canada. The incorporators are Dr. W. R. Campbell and Mayor M. B. Butler, of Niagara Falls, N. Y.; L. McGlashan, A. Fraser, E. S. Fraser, of Niagara Falls, Ont.; and T. M. Brush, of Elyria, O.

General Superintendent Watts, of the Long Distance Telephone Company of Virginia, states that the line up the Peninsula connecting Newport News, Williamsburg and Richmond will be in operation in 30 days. The wire has been stretched in this direction as far as Warwick Courthouse.

The Home Telephone Company's Sylvania, O., branch, has been incorporated as a separate company. It is styled the Sylvania-Lucas County Home Telephone Company, and is capitalized for $10,000. The incorporators are Frank W. Wachter, F. F. Graves, Henry W. Barfield, Bernard J. Wagner and Charles E. Sumner.

A certificate of increase of the capital stock of the Farmington, Conn., Valley Telephone Company of New Britain rom $7,000 to $10,500, has been filed with the Secretary of State.

Articles of incorporation of the Home Telephone Comgany of Ozark, Ark., were lately filed with the Secretary of State. The capital stock is $15,000, all of which has been subscribed.

From Ocean to Ocean by Telephone.

A recent dispatch from Helena, Mont., says it is stated that an agreement has been reached between the Rocky Mountain Telephone Company and the Northwestern Telephone Company, whereby the former will build a line at once from its present eastern terminus at Billings to Miles City, Mont., while the Northwestern Company will build west from its North Dakota terminus to Miles City, thus forming a possible circuit (via New York, Chicago, the Twin Cities, Helena and Portland) from Boston to San Francisco and Los Angeles.

Independents Buy the Columbia.

Napoleon Davis and John Lamont, president and vice-president, respectively, of the Columbia Telephone Company, Portland, Ore., have disposed of their interest to a syndicate of capitalists from Ohio, and will retire from the company. All parties to the deal decline to give the purchasing price.

The new owners of the system are the same men that are putting in an independent telephone system in Seattle. The intention is to unite the two systems, and establish long-distance connection between Portland and Puget Sound points. Eventually, it is said, the system will be extended so as to include all points of importance in Washington and Oregon, but for the present the connection will be between Seattle and Puget Sound.

In addition it is proposed to improve the Columbia Telephone system in Portland, and an effort will be made to extend the service throughout the city.

Judge J. W. G. Blackstone, of the Circuit Court of the County of York, Va., has granted a charter to the Peninsula Telephone & Telegraph Company. The following are the officers for the first year: President, Thomas S. Harris, of Tampico, Va ; vice president, Albert A. Harris, of Tampico; secretary and treasurer, Richard W. Shields, of Yorktown, and these, with Thomas A. Clements, of Halstead Point, compose the board of directors. The principal office of the company will be located at Yorktown. The company will run a line to all points of interest on the Peninsula. It is thought that it will connect with the Virginia Long Distance Telephone Company.

In Texas successful independent telephone exchanges are in operation in Waco, San Antonio, Horuton, Bryon, Abilene, Palestine, Huntsville, Georgetown, Corsicana and a large number of the smaller towns, while exchanges are being built in Austin, Temple, Belton, Taylor, Tyler and Beaumont. Toll lines are being rapidly built to connect these towns and a number of smaller points, the contracts having been let for about 2,350 miles of copper trunk lines. Franchises have been granted in Cleburne and Waxahachie, and work will soon begin there, while franchises are now pending in the only other two larger cities.

The city council of Owingsville, Ky., has granted a 25 year franchise to the Home Telephone Company. This company proposes to establish and operate an exchange, and the line connecting all towns in Bath, Montgomery, Flushing, Rowan and Menifee Counties.

The Western Electric Company of Chicago has sued the Citizens' Telephone Company of Columbus, O., for the infringement of patents. The suit is based upon the claim of the electric company to the ownership of the signaling device used by the Citizens' Company, and the court is asked to enjoin the company from ever using the device again.

The Covington Telephone Company, which was recently organized by the business men of Covington, Ky., on account of dissatisfaction of rates, etc., of the Southern Bell's local exchange, will have its line completed and ready for service by September 1.

Thirty thousand dollars is to be expended in the erection of an office building for the Louisville, Ky., Home Telephone Company.

It is stated that the Automatic Telephone Company has commenced to operate its system in Fall River, Mass.

TELEPHONE INCORPORATIONS.

The Eureka Telephone & Construction Company, Chicago, Ill. Capital stock, $50,000. Incorporators: H. R. Platt, J. H. Rollins and Sydney Stein.

The Combination Telephone Directors' Company, Indianapolis, Ind. Capital stock, $5,000. Directors: B. C. Wheat, E. L. Donohue and Charles Darling.

The Humboldt Telephone Company, Humboldt, Ill. Capital stock, $2,500. Incorporators: James McDougle, S. C. Ashbrook and E. M. Mulliken.

GENERAL ELECTRICAL NEWS.

Lighting.

Bradner, O.—This village has decided to issue bonds in the sum of $135,000 for the erection and maintenance of an electric light plant.

Canton, O.—L. E. Myers, superintendent of construction of the Canton-Akron electric line, has announced that his company will have an electric light plant. Light will be offered to Akron and Canton and intervening towns. Mr. Myers has just returned from a conference with Eastern capitalists who are backing the company. He says the decision to furnish light is absolute.

Clay Centre, Kan.—The electric light plant of this city, was destroyed by fire. Loss, $15,000; insurance, $5,000. The plant was owned by Williamson, Wickstrum & Co.

Conneaut, O.—The proposition to issue bonds for electric lighting, sewer, street improvements and fire and police buildings carried,

Delphos, O.—The council has ordered an election for a vote on the proposition to issue $25,000 bonds for the erection of a municipal electric light plant.

Fond du Lac, Wis.—The Fond du Lac Street Railway & Light Company will take immediate steps to install in this city a new street lighting system, entirely replacing the old lamps that have been used for a number of years with new and up-to-date lamps that are guaranteed to give the best of service.

Huntsville, Ala.—The Huntsville Electric Railway, Light & Power Company will improve its lighting plant and service, extending the incandescent system throughout the residence section. A. L. Sweeney is president.

Indianola, Miss.—W. T. Pitts, of this city, wants prices on a complete outfit for a 5,000 light electric plant, including insulators, lamps, etc.

Lyons, Mich.—Next week a proposition to bond for $2,500 for extensions of the local electric lighting system will be voted on here.

Madison, Wis.—The common council passed a resolution to investigate private and municipal lighting plants of other cities with a view to establishing a city light plant next year.

Manistee, Mich.—The council of this city will receive bids until September 3 for lighting the streets with electric arc lights. W. H. Pfeiffer, city clerk.

Nashville, Tenn.—W. H. Crawford & Co., 203 Union street, Nashville, will be in the market soon for machinery to erect a 5,500 horse-power electrical plant to transmit power 75 miles.

New Britain, Conn.—The new addition to the Russell & Erwin plant has been finished and is equipped as a head room. The motive power has been furnished by electricity. The company is gradually extending its electrical plant and has plans for running the entire lock department by electricity in the course of time. The plans call for four generators and so far two of them have been installed. All the lighting is done by electricity and some of the rooms are run by electric power. It is considered cheaper to use electricity than to run them by the steam plant from the screw shop. The two factories are quite a distance apart, and it means considerable waste to carry power from one to the other.

New London, Wis.—New London may get a combined waterworks and electric lighting plant under municipal ownership. The council has authorized a committee to get plans and specifications.

Roanoke, Ala.—Thomas V. Hall of West Point, Miss., has completed plans for the city's proposed waterworks and electric light plant for which $35,000 was appropriated recently. Bids are advertised for.

Saranac, Mich.—A special village election to decide the electric light question resulted in 206 for and 9 against. This means the establishment of a plant here within 60 days. Everybody celebrated.

Starke, Fla.—This city will install a complete system of waterworks and electric lights. Address E. P. Duncan, city engineer.

York City, Pa.—William L. Wilhelm, electrician, has received a contract for the construction of an electric plant at Red Lion.

Street Railways.

Atlanta, Ga.—The Atlanta Railway & Power Company and the Atlanta Rapid Transit Company have each obtained permission to build proposed extensions of their railways.

Bessemer, Ala.—The city council has granted a franchise for the proposed Steel Cities Railway Company, which is represented by R. F. Hanneman.

Birmingham, Ala.—The Birmingham Railway, Light & Power Company contemplates extending its railway one and one-half miles.

Covington, Ky.—County Judge Shine, of Kenton County, has decided that an electric railroad company has the right to condemn property for the purpose of constructing its road.

Dayton, O.—The Dayton, Covington & Piqua Traction Company has secured a franchise in Piqua.

Dowagiac, Mich.—Talk has been revived about the Kalamazoo Valley electric line that will connect Kalamazoo and Benton Harbor by trolley. T. W. Van Cleve is the promoter.

Eaton Rapids, Mich.—Work will be commenced between Marshall and Albion on the electric road at once.

Grand Rapids, Mich.—Grand Rapids and Kalamazoo are to be connected by an electric line. A Cleveland syndicate is financing the deal, and they announce with every assurance that they have made all arrangements for the building of the road.

Harrisburg, Pa.—Council has granted a franchise to the Chambersburg, Greencastle & Waynesboro Trolley Company.

Haileyville, Ark.—There is talk of establishing an electric line between this place and Hartshorne.

Hamilton, O.—The Hamilton, Glendale & Cincinnati Electric Transit Company has been granted the right-of-way into this city.

La Porte, Ind.—The La Porte County commissioners have granted to the Chicago, Valparaiso & Michigan City Railroad Company, which intends to connect Chicago, Valparaiso, La Porte, Hobart, Crown Point, Hammond, Westville, Michigan City and Hesston with an electric line, a franchise to construct and operate a road on the highways in this county.

Lexington, Mo.—There is some talk of an electric road between this city and Kansas City.

Natchez, Miss.—A sufficient amount of stock having been subscribed the Natchez Electric Street Railway, organized under its charter with E. H. Ratcliff, president; Capt. James Lambert, vice-president, and E. H. Jacks, secretary and treasurer. The company will continue to solicit subscribers to the bond issue, and when $25,000 has been subscribed the work of construction will be taken up. The road will cost $50,000.

North Adams, Mass.—Work has started at Adams on the electric road which is to connect that town with Cheshire.

Pittsburg, Kan.—Surveying will commence at once on an extensive system of electric trolley lines in this part of the State. The proposed line will run from Pittsburg to Galena, taking in Cherokee, Weir City, Scammon and Columbus. At Galena the new line will absorb the present electric road between that city and Joplin. North from Pittsburg the road will extend to Minden Mines, Mo.

Rutherfordton, N. C.—D. F. Morrow is interested in the movement for constructing an electrical railway to Asheville and Chimney Rock.

Shreveport, La.—The People's Belt Railroad Company has been incorporated with a capital stock of $100,000 to construct a five mile belt railway. Wm. L. Ingersoll, C. H. Minge, L. M. Carter and J. D. Wilkinson and others are interested.

Washington, D. C.—Philadelphia capital is to build a trolley line to connect Washington with the famous old-time watering place at Point Lookout on the north of the Potomac where the river widens into Chesapeake Bay. The air-line distance from the dome of the Capitol to the beach at Point Lookout is less than 80 miles, but, because numerous small tributaries must be avoided, the trolley road will be about 98 miles in length. The company is capitalized for $1,000,000.

Yorkville, Ill.—Efforts are being made to secure capital to build an electric road from here to Sandwich through Plano, and the prospects of success are reported good.

Manufacturing.

El Campo, Tex.—An electric plant to cost $50,000 is to be erected at El Campo, Wharton County, for the purpose of supplying power to operate the irrigating pumps which are necessary to the rice crop, and for other manufacturing purposes.

New York.—William Roche, manufacturer of the New Standard Dry Battery, 42 Vesey street, whose building and stock was considerably damaged by fire on the 18th inst., says he will have everything in running order within a week and will have better facilities to fill orders.

Shepherdstown, Md.—A party of manufacturers were here recently looking at the cement mill property, and negotiations are pending for the purchase of the mill and the water rights. These men recently bought the water right at Dam No. 5 on the Potomac, and at Watson's mill on the Shenandoah. They desire to possess these properties for development of electricity for commercial purposes.

Company Matters.

Charleston, W. Va.—The Charleston & Kanawha Valley Power & Railway Company was incorporated here by Thomas J. Carmack, Howard T. Goodwin, John W. Coburn, C. N. Osborn and E. D. R. Sutton. The capital is $500,000, and the purpose of the company is to build electric lines to St. Albans and Montgomery, with probably an extension from the latter place to Kanawha Falls.

Wilkes-Barre, Pa.—A controlling interest in the Auburn, Light, Heat & Power Company of Auburn, N. Y., which was owned by capitalists in this city, has been sold to the Electric Company of America of Philadelphia, a corporation which owns electric light companies in various cities. The price paid is said to be in the neighborhood of $40 a share, and the offer to purchase is extended to the minority stockholders at the same price paid for the majority. The new officers elected were: President, Col. A. Loudon Snowden; vice-president, H. T. Hartman; secretary and treasurer, Frank A. Ball, all of Philadelphia.

Power and Transmission.

Lansing, Mich.—The St. Mary's Falls Power Company, capitalized at $100,000, has filed articles of incorporation at Lansing, Mich. This company proposes to utilize the power going to waste in St. Mary's Falls. Francis H. Clergue, of the Soo, and Edward V. Douglass, of Philadelphia, are the owners of all but 50 shares of the stock of the company.

Omaha, Neb.—The most gigantic power scheme ever undertaken in the United States, if not in the world, with the only exception of the power plant at Niagara Falls, is shortly to be undertaken on the Nebraska prairies. Twenty million dollars are involved in the transaction, which is backed by J. Pierpont Morgan, who is reported to have consented to place $2,000,000 in the undertaking. The power derived from the plant will, according to the engineers' figures, be equal to 30,000 horse-power for 24 hours a day, or 50,000 horse-power for 10 hours a day.

Richmond, Va.—The directors of the Virginia Electrical Railway & Development Company have authorized the enlargement of their plant on the James River so as to develop its full capacity, 12,000 horse-power.

West Superior, Wis.—Mayor Parker has signed the ordinance passed by the council granting a franchise to the Black River Falls Company to bring power into the city from the falls, situated 16 miles from here. The company is expected to get at work at once and will at first develop about 1,200 horse power from the falls. The system of dams will increase the fall of water over the drop in the river.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by Electricity from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Albany, N. Y.—Aug 26						
United Traction (Consolidation of the Albany and Troy City Railway.)	100	$5,000,000	$5,000,000	1¾ % Q.,	105	107
Allentown Pa.—Aug 26						
Allentown & Lehigh Val. Trac. Co	...	4,000,000	1,500,000	....	--	15
Bridgeport, Conn—Aug 26:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug.,	100	...
Baltimore Md—Aug 26						
a United Rail ways & Elec. Co...com	50	24,000,000	18,000,000	....	16⅛	16¼
Boston, Mass.—Aug 26						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15,	...	..
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	15	16
North Shore Traction Co........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	85	87
b West End Street Ry. Co.......com.	50	10,000,000	9,085,[illegible]	3½ % S., Oct.,	96	96¼
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Jan.	110	110⅛
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 99,	186	187
Brooklyn N. Y.—Aug 26.						
Brooklyn City Ry	100	2,000,000	1,928,400	....	242	244
Brooklyn Rap. Transit Co., tr certf..	100	48,000,000	48,000,000	....	76½	76¾
*c*Brooklyn Heights Railroad	....	200,000	200,000	....	107	109
**d*Brooklyn City RR.........guar	100	12,000,000	12,000,000	3½ % Q., Jan.,	237	239
*e*Brooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	2,000,000	1,884,200	2½ % Nov.,	325	330
Kings County Elevated	....	4,750,000	4,750,000	....	--	...
Kings County Traction Co	100	4,500,000	4,500,000	1 % July	--	--
Nassau Electric Railroad ....pfd.	......	6,000,000	6,000,000	....	82	85
*f*Atlantic Avenue Railroad	50	2,000,000	2,000,000	....	--	--
*g*Brooklyn, B. & W. E. Railroad..	....	1,000,000	1,000,000	....	--	--
Buffalo N. Y.—Aug 26						
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	....	74	75
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec.	91	92
Columbus O.—Aug 26						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb.	45	47
Columbus Street Railroad, pfd....	100	1,500,000	1,500,000	....	102	105
Charleston, S. C.—Aug 26						
Charleston City Ry. Co	50	100,000	100,000	3 % S.	--	--
Enterprise City RR. Co	25	1,000,000	250,000	....	--	--
Chicago, Ill.—Aug 26						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31,	209	210
Chicago & South Side R. T. RR.....	100	10,828,800	10,828,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12¾	13
Metropolitan West Side Elev. Ry...	100	15,000,000	7,000,000	Feb 28 1900.	3[illegible]	36½
Met. West Side El., pfd	10[illegible]	15,000,000	9,000,000	....	97½	37½
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan.	209	210
*h*North Chicago City RR	100	500,000	249,900	....	200	202
South Chicago City Railway	100	2,000,000	1,608,200	....	108	109
West Chicago St. RR. Co	100	20,000,000	18,189,000	1½ % Q., Feb.	100	100½
Union Traction Ry.............com	....	1,250,000	624,900	35 %	17	17¼
Union Traction Co..............pref.	100	2,000,000	2,000,000	5 % S.	60	61
Cincinnati, Ohio.—Aug 26:						
Cincinnati Inc. Plane Ry........com.	50	1,000,000	575,000	....	--	--
Cincinnati Inc. Plane Ry.........pfd.	50	150,000	150,000	½ % Feb.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	3,000,000	3,500,000	2½ % Feb.	75	76
Cincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan.	124½	125
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan.	126½	127
Cleveland, Ohio—Aug 26:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan.	48	50
Cleveland City Ry	100	8,000,000	7,600,000	8-5 % Jan.	102	103
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct.,	83½	85⅛
Detroit, Mich.—Aug 26:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	--
Ft. Wayne & Belle Isle Ry	100	....	1,200,000	....	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	....	1,000,000	1,000,000	....	...	75
Wyandotte & Detroit River Ry....	100	250,000	200,000	....	100	110
Dayton O.—Aug 26						
City Railway Co..............com.	100	1,500,000	1,470,600	1¼ % Q.	140	145
City Railway Co..............pfd.	100	600,000	600,000	1½ % Q.	170	..
People's Street Railway	....	1,100,000	1,100,000	....	114	115

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Hartford Conn—Aug 26						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Oct.,	150	-
Hartford & West Hartford	100	1,000,000	247,000	....	--	-
Holyoke Mass.—Aug 26						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., June,	207½	212
Hoboken N. J.—Aug 26						
North Hudson Co. (N. J.) Ry. Co...	25	1,250,000	1,000,000	8 %,	150	
Indianapolis, Ind—Aug 26						
**Indianapolis Street Ry	....	5,000,000	5,000,000	....	25	25½
Lancaster, Pa.—Aug 26						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	--	..
Lancaster & Col. Electric Ry	....	....	37,500	....	--	...
West End Street Railway	....	....	....	....	--	..
Louisville, Ky.—Aug 26:						
Louisville Ry..................com.	100	4,000,000	3,500,000	1¼ %., April.	82	83
Louisville Ry..................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1,	112	113
Minneapolis, Minn.—Aug 26						
Twin City Rapid Transit.........com.	100	17,000,000	15,010.000	....	89	89¼
Twin City Rapid Transit....7 % pfd.	....	8,000,000	1,712,200	1¾ %, Oct.	136	137
Montreal, Canada.—Aug 26						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	290	291
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	‡109¾	109⅞
Memphis Tenn.—Aug 26						
Memphis Street Railway Co	100	500,000	500,000	....	25	–
New Haven, Conn.—Aug 26:						
Fair Haven & Westville RR	25	2,000,000	2,000,000	3 % S., Sept.	39	41
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July	...	...
New Haven & Centerville	100	700,000	800,000	....	..	–
Winchester Avenue RR	25	1,000,000	600,000	....	45	46
New Orleans, La.—Aug 26						
Canal & Claiborne RR. Co	40	240.000	240,000	4 % S., July,	..	..
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Oct.	148½	153
New Orleans Traction Co new com.	100	....	....	....	26	28
New Orleans Traction Co new pfd.	100	....	....	....	102	103
*a*Crescent City RR...........guar.	100	2,000,000	2,000,000	3 % S., Jan.,	20½	26
*b*New Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan.,	..	..
Orleans Railroad	50	500,000	185,000	1½ %., June,	..	52
St. Charles Street Railway	50	1,000,000	1,000,000	1¼ %. Oct.,	56½	57
New York—Aug 26:						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	260
*c*Christopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Oct.,	175	185
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Nov.	120	185
*d*Metropolitan Street Ry. Co	100	45,000,000	45,000,000	2½ % Q., Feb., 1901.	169½	169¾
*e*Bleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July,	32	36
*f*Broadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	244	249
*g*Cen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,[illegible]0,000	2¼ % Q.	205	210
*h*Eighth Avenue RR	100	1,000,000	1,[illegible]0,000	....	400	410
*i*42d St. & Grand St. Ferry RR. guar	100	750,000	7[illegible]8,000	4½ % Q.	390	400
*j*Ninth Avenue RR..........guar.	100	800,000	8[illegible]0,000	....	198	205
*k*Sixth Avenue RR...........guar	100	2,000,000	2,000,000	....	200	205
*l*Twenty-third St. R. R. Co..guar.	100	600,000	6[illegible],000	4½ % Q.	409	410
Second Avenue RR	100	2,500,000	1,8[illegible],000	2 % Q., Jan.,	212	215
Third Avenue RR	100	12,000,000	10,0[illegible]000	$1.75 p. sh. Feb.	121	121
*m*42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,50[illegible]000	....	65	75¼
*Union (Huckleberry) Ry	100	2,000,000	2,00[illegible]000	....	190	200
Newark N. J.—Aug 26						
Consolidated Traction Co of N. J...	100	15,000,000	5,000,000	....	67	68
North Jersey Railway Co	100	6,000,000	[illegible],000,000	....	24	24½
United Elec. Co. of New Jersey..	100	504,000	504,000	11¾ % A.	280½	282
Pittsburg, Pa.—Aug 26						
Allegheny Traction Co	50	500,000		....		
*o*Consolidated Traction Co....com.	50	15,000,000		2 %, Jan.	27	28
Consolidated Traction Co.......pfd.	50	9,478,850		8 %, Nov.	20	21
*p*Central Traction Co	50	1,500,000		1½ % Nov.	58	59
*q*Citizens' Traction Co	50	3,000,000		6 % A.	78⅛	78¼
*r*Duquesne Traction Co	50	3,000,000		6 % A.	72¾	72½
*s*Pittsburg Traction Co	50	2,500,000		8½ %, Nov.	..	...
Federal St. & Pleasant Valley Ry..	25	1,400,000		2½ %, July,	..½	..
Pgh., Allegheny & Man. Trac. Co....	50	3,000,000		2 %, Aug.	27	29
Pittsburg & Birmingham Trac. Ry..	25	1,500,000		1 %, Oct.	..	..
Pittsburg & West End Ry	50	3,000,000		5 % A., June	41	42½
United Traction Co.............com.	50	17,000,000		J. & J.	..	..
United Traction Co.............pre	50	3,000,000		J. & J.	13¼	13½

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* Unlisted. ‡ Ex div.

a The United Railways & Electric Company comprises in its organization the Baltimore Consolidated Railway Company, the Baltimore City Passenger Railway Company, all the lines of street railway operated by these companies, and also the Central Railway Co of Baltimore. The pref stock of U R & Elec Co has been issued in the form of income bonds.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250 100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company

k Majority of stock owned by Chicago, West Division Railway Company; 5 % on $1,000,000 stock guaranted by West Chicago Street Railway Company, lessee.

Cincinnati St. Railway purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. | Outstanding. ‡ Ex-div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Ry. at 8 % on stock until Oct. 1, 1897: thereafter 9 %.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1895, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter.

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 % on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens' Duquesne, Fort Pitt & Pitt'b Traction.

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock.

s Leased to Consolidated Traction Company for 7 % on capital stock.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
New Bedford Mass.—Aug 26						
Union Street Railway Co..........	100	$250,000	$350,000	2 %, Feb.	160	165
Northampton, Mass—Aug 26						
Northampton Street Ry	100	300,000	225,000	4 % A., June.	170	178
Omaha, Neb.—Aug 26						
Omaha Street Ry....	100	5,000,000	5,000,000	3 % A. and N.	55	65
Paterson N. J.—Aug 26						
Paterson Ry. Co..........	100	1,250,000	1,250,000	....	54	--
Providence, R. I.—Aug 26						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Oct.	109	110
Philadelphia.—Aug 26						
Fairmount Park Trans. Co...$50 pd.	50	2,000,000	1,770,000	2 %, Dec.	23	24
Hestonville, Man. & Fairmount....	50	1,966,100	‖1,966,100	2½ %, July 15,	47	48
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	588,900	‡588,900	3 % S—July,	75	76
aFairmount Pk. & Had. Pass. Ry.	50	300,000	300,000	3 % Feb. 1,	26½	27
Union Traction Co............$17½ pd	50	30,000 000	29,980,450	....	26¼	27
cElectric Traction Co..............	50	....	8,297,920	....	--	...
dCitizens' Passenger Ry........	50	500,000	†192,500	$8 share Q.	345	--
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.	450	451
fLehigh Avenue Ry. Co..........	50	1,000,000	....	....	48	...
fLombard & South Street Ry...	25	....	1,000,000	A. & O.	90	90½
dSecond & Third Streets Ry....	50	1,060,000	†771,076	$9 share A, Mar.	300	...
People's Traction Co............	50	10,000,000	†6,000,000	3 %, A., April,	...	--
gGermantown Passenger Ry....	50	1,500,000	‖572,800	$5.25 share—	150	151
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan.,	151	152
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	....	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co.......	50	30,000,000	‖20,000,000	$2 p. sh. Oct.	97⅝	97¾
jCatherine & Bainbridge St......	50	....	‖400,000	6 % A—Mar.,	...	--
jContinental Pass. Ry.....guar..	50	1,000,000	‖580,000	$6 share—July	158	157
Empire Passenger Ry. Co.......	50	600,000	‖600,000	....	...	--
jPhiladelphia City Pass. Ry......	50	1,000,000	‖475,000	$7.50 share July	208	208¼
jPhiladelphia & Gray's Fy. RR..	50	1,000,000	298,650	$3.50 share July	100	--
jRidge Avenue Passenger Ry....	50	750,000	‖420,000	$12 share, July	308¾	309
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July,	...	--
j17th & 19th Sts. Pass. Ry. guar...	50	....	‖250,000	1½ % S., July,	--	--
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖385,000	$11 sh. A., July,	300	--
jUnion Passenger Ry. Co.........	50	1,500,000	‖900,000	$9.50 shre, July	239	240
jWest Philadelphia Pass. Ry.....	50	750.000	‖750,000	$10 share, July	262	263
Rochester, N. Y.—Aug 26						
Rochester Railway Co..............	100	5,000,000	5,000,000	....	25	28
Reading, Pa.—Aug 26						
jReading Traction Co..............	--	1,000,000	1,000,000	Semi-an.,Jan. & Jy	24	26
kCity Passenger Ry..............	50	850,000	850,000	Jan.,	188	...
lEast Reading Electric Ry..........	50	1,000,000	‡1,000,000	Jan.,	70	--
St. Louis Mo.—Aug 26:						
Fourth Street & Arsenal Ry........	50	300,000	150,000	....	--	--
Jefferson Avenue Ry. Co..........	50	400,000	400,000	2 % Dec.	--	--
Lindell Ry..........	100	2,500,000	2,400,000	1¼ % Jan.	--	--
National Railway Co..............	--	2,500,000	2,479,000	1½ % Jan.	--	--
Cass Avenue & Fair Grounds....	--	2,500,000	2,500,000	....	--	--
Citizens' RR..........	100	2,000,000	1,500,000	4 %, Oct.,	--	--
St. Louis RR..........	100	2,000,000	2,000,000	2½ %, Jan.,	...	--
Missouri RR..........	50	2,400,000	2,300,000	1½ % Jan.,	--	--
People's RR. Co..........	50	1,000,000	300,000	50c., Dec.,	--	...
United Electric Ry............com.	50	500,000	500,000	....	27	27½
United Electric Ry....... 5 % pref.	100	1,000,000	1,000,000	3 %, Jan.,	79½	81
St. Louis & Suburban Ry..........	100	3 000,000	2,500,000	....	90	95
Union Depot RR..........	100	4,000,000	4,000,000	3 % A., July,	--	--
San Francisco, Cal.—Aug						
California St. Cable RR..........	100	1,000,000	600,000	50c. monthly.	117	119
Geary Street Park & Ocean RR......	100	1,000,000	375,000	$2.50 share,	50	--
Market Street Ry..........	100	18,750,000	18,750,000	Q., 60c. per share.	61½	63⅛
Presidio & Ferries RR..........	100	1,000,000	550,000	....	--	16
Scranton Pa—Aug 26:						
Scranton Railway Co..........	50	6,000,000	2,500,000	....	29	30
mScranton & Carbondale Trac. Co..	100	500,000	500,000	....	16⅛	...
mScranton & Pittston Traction Co..	100	1,050,000	1,050,000	....	--	--
Springfield Ill.—Aug 26						
Springfield Consolidated Ry	100	750,000	750,000	....	--	--
Springfield O.—Aug 26						
Springfield Street Ry..........	100	1,000,000	1,000,000	....	--	11
Springfield, Mass.—Aug 26						
Springfield Street Ry..........	100	1,200,000	1,166,700	8 % A.	207	212
Toronto Canada.—Aug 26						
Toronto Street Ry..........	100	6,000,000	6,000,000	1¾ % S.	109¼	110½
Montreal Street Railway Co..........	.....	4,000,000	4,000,000	4 % S.	279	280
Washington, D. C.—Aug 26						
Belt Ry. Co..........	50	500,000	500,000	....	--	--
Capital Traction Co..........	100	‡12,000,000	12,000,000	65c. per sh, Oct.	103¾	103⅞
Columbia Ry. Co..........	50	400,000	400,000	6 % A.	--	...
Eckington & Soldiers' Home Ry....	50	707,000	652,000	....	35	40
Georgetown & Tenallytown Ry.....	50	200,000	200,000	....	20	21
Metropolitan RR. Co..........	50	1,000,000	458,900	2½ % Q.	--	--
Worcester, Mass.—Aug 26						
*Worcester Traction Co........com.	100	8,000,000	8,000,000	....	32¼	35
Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb.,	107	108
Worcester & Suburban Street Ry...	100	550,000	542,500	4½ %.	...	85
i **Wilkesbarre, Pa.**—Aug 26						
Wilkesbarr & Wyoming Val Trac ..	0	5,000,000	5,000,000	1%, Jan.,	25	26

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex-div.

a Leased to Hestonville, Man & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Company at a rental of $10,000 per annum in 1896-7-8, n a. $20,000 in 1899-1900 and $30 000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6 % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Co., formerly Scranton Traction Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Boston, Mass.—Aug 26						
American Tel & Tel Co..........	100	50,000,000	28,650,000	1½ % Q., Jan.	164	164¼
Erie Telegraph & Telephone Co....	100	....	....	1 % Q., Feb. 20,	48	48¼
New England Telephone Co..........	--	10,394,600	10,304,600	$1.50 p. sh. Feb	139	140
New York.—Aug 26						
American Telegraph & Cable Co...	100	14,000,000	14,000,000	1¼ % Q	91	94
*Central & South Am. Teleg. Co.....	100	6,500,000	6,500,000	1½ % Q.	105	110
*Commercial Cable Co..............	100	10,000,000	10,000,000	1¾ % Q.	173	175
Franklin Teleg. Co.......2½ % guar.	100	1,000,000	......	1¼ % S.	42	50
Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1 % Q., Feb.,	--	--
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	108	109
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	116	118
Mexican Telephone Co..............	100	2,000,000	......		2	2½
*New York & New Jersey Tel. Co..	100	5,000,000	3,728,000	2½ % Q., Jan.,	168	178
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	70	75
*Postal Telegraph Cable Co.........	100	15,000,000	15,000,000	1 % Q.	--	--
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	100	110
†Commercial Union Telegraph Co...	25	500,000	500,000	3 % S., Jan.,	115	--
Western Union Telegraph Co.......	--	......	97,370,000	1¼ %, Q, Jan.	93⅛	93¼
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Aug 26						
American Dist. Teleg. (Phila.).....	25	400,000	......	1 % Q.	26	37
Bell Teleph. Co. (of Canada.)......	100	3,960,000	3,564,000	2 % S.	188	--
Chesapeake & Potomac Telep. Co..	100	......	......	....	67	70
Chicago Telephone Co..............	100	......	......	......	200	210
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	148	150
Empire & Bay States Telegraph Co.	...	......	......	....	75	76
Hudson River Telephone Co.......	109	2,000,000	2,000,000	1 % Q.	120	125
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q	122	126
Providence (R. I.) Teleph. Co.......	50	......	......	....	96	97
Southern New Eng. Teleph. Co....	100	3,000,000	......	....	...	--

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 26						
Fort Wayne Electric trust receipts..	--	......	......	....	115	125
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	15	25
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	--	.
General Electric Co. [new]...... "	100	18,276,000	18,276,000	2 % Q., July, 1901	261¾	265
T.-H. Elec. Co..T. Secur., Series C.	--	......	......	....	22	23
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	70	70¼
Westinghouse El. & M'fg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q.,	78¼	79
Westinghouse El. & M'fg. Co. rights.	50	11,000,000	8,195,126	......	1¼	1⅜
New York.—Aug 26						
Edison Elec. Ill'g Co., New York..	100	9,188,000	7,988,000	....	119	120
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	2,000,000	1½ % Oct., '98.	--	--
Edison Ore Milling Co..............	100	......	......	....	8	12
Electric Vehicle Co..............com.	--	......	......	....	--	--
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	--	...
General Electric Co. [new].... "	100	18,276,000	18,276,000	2 % Q., July, 1901	264¾	265
Interior Conduit & Insulation Co...	100	1,000,000	1,000,000	....	41	--
‖ Kings Co. El. L. & P. Co.	100	2,500,000	2,500,0 00	A. & O.	110	125
Pittsburg, Pa—Aug 26						
Allegheny County Light Co	100	500,000	500,000	J. & J.	168	172
East End Electric Light Co.........	50	300,000	300,000	Q	--	--
Philadelphia, Pa.—Aug 26						
Edison Electric Light Co.....	100	2,000,000	......	......	144	144½
*Electric Storage Battery Co..com.	100	8,500,000	......	......	76	80
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	76	80
Northern Elec. Light & Power Co..	10	550,000	550,000	......	18	18½
Southern Elec. Light & Power Co..	10	187,500	187,500	....	30	--
Miscellanoeus.—Aug 26						
Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	......	......	47	48
Missouri-Edison (St. Louis)....com.	--	......	......	....	20	21
Eddy Electric Mfg. Co..............	25	......	......	....	9	10
Hartford (Conn.) Elec. Light Co....	100	350,000	......	....	190	191
Hartford (Conn.) Lt. & Power Co..	25	175,000	......	....	9	10
New Haven (Conn.) Elec. Lt. Co....	100	100,000	......	....	90	
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct.,	93	94
Rhode Island Elec. Protec. Co.......	100	......	......	....	118	120
Royal Elec. Co. (Montreal)..........	--	1,000,000	......	2% Q ‡	250	251
Toronto (Canada) Elec. Light Co...	100	1,085,000	1,085,000	1¾ % Q	136	138
Thomson-Houston Welding Co.......	100	......	......	3 % S, Dec. 1,	--	100
Woonsocket (R. I.) Electric Co.....	100	......	......	....	105	106

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

‖ Recently acquired the Edison Illuminating Co. of Brooklyn and its constituent company, the Municipal Electric Light Co.

ALLIED INDUSTRIES.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Aug 26						
American Electric Heating Co.........	50	10,000,000	....	....	--	--
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh.	--	--
United Electric Securities Co...pfd.	100	......	1,000,000	$3.50 p.sh.	--	100
New York.—Aug 26						
Consolidated Electric Storage Co...	...	......	....	....	8	12
Safety Car Heating & Lighting Co..	100	......	....	......	150	155
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	--	--
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 % A	113	114
Philadelphia Pa.—Aug 26						
Electro Pneumatic Trans. Co	10	1,500,000	......	----	1½	1¾
United Gas Improvement Co..scrip.	50	10,000,000	......	----	--	162
Welsbach Commercial Co.....com.	100	3,500,000	......	----	20½	21½
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	73	75
Welsbach Light Co..................	5	525,100	......	....	54	55
Welsbach Light Co., Canada.	5	500,000	......	....	1	1½
Pittsburg, Pa.—Aug 26:						
Carborundum Mfg. Co...............	100	200,000	200,000	....	--	
Standard Underground Cable Co. --	100	1,000,000	1,000,000	Q	224	227
Miscellaneous.—Aug 26						
*Barney & Smith Car Co.......com.	100	......	1,000,000	----	20	25
*Barney & Smith Car Co........pfd.	100	......	500,000	2 %	120	129
Billings & Spencer Co..............	25	......	....	....	32	--
Consol. Car Heating Co.............	100	1,250,000	1,250,000	1½ % Feb	54	56½
Johns-Pratt Co.....................	100	....	....	----	105	109
Pratt & Whitney Co..........com.	100	......	....	----	--	...
Pratt & Whitney Co............pfd	100	....	......	----	85	90
Stillwell-Bierce Co..............com.	--	....	......	----	--	50
Stillwell-Bierce Co..............pfd.	--	....	....	2 % Sept	65	70
Schultz Belting Co..................	100	500,000	....	....	80	90
St. Charles Car Co..................	--	----	----	----	80	86

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany N. Y.

Date of Quotation—Aug 26, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry. Co......Cons. mtg. 5s	$500,000	427,500	1940	J. & J.	117⅛	......
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*116½	......
‖Watervliet Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*125	....
‖Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*124	126
Troy City Railway Co.....................1st 5s	....	....	1942	......	*116½	118

‡Interest guar. by Albany Ry. Co

‖Principal and interest guar by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Aug 26 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
United Electric Ry. Co...1st mtg. g. 4s	38,000,000	18,000,000	1949	M. & S.	102	102¼
" " " ....income 4s.	14,000,000	....	1949	J. & D.	74¾	75
Baltimore City Pass. Ry..1st mtg. g. 5s.	2,000,000	2,000,006	1911	M. & N.	118⅞	......
†Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	119	120
†Baltimore Trac. Co. Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	104⅛	......
†Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	121	121⅛
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	101	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	102½	......
†Central Pass. Ry. Co..........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
†Central Pass. Ry. Co..Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	119	121
†City & Suburban Ry.....1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	116	117
†Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	117	......

☞ All of the bonds of the above companies, marked †, have been assumed by the United Railways & Electric Company.

Boston Mass.

Date of Quotation—Aug 26, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	114	115
West End Street Ry.........Deben. g. 5s.	3,000,000	3,900,000	1902	M. & N.	104⅛	106
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	112	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Aug 26, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry..............1st mtg. 6s.	850,000	....	....	J. & J.	106	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Aug 26, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry..............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¾	2¼
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T..............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry......1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	108½	109
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	96	96⅛
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	106	......
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	......
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	......
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	108	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	......	111
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	101	102
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	106⅝	107
‖W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	....	....

†Redeemable at option on 60 da. notice.

‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.

¶Subject to call after Oct. 1, 1899, at $110 and interest.

‖Assumed by W. Chi. RR. Co., lessee

§Int. guar. by W. Chicago St. RR. Co

Cincinnati O.

Date of Quotation—Aug 2 6 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	114⅛	115
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103⅛	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	114	......
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	581,000	581,000	1906	M. & S.	108¾	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	121⅛	122⅛
‡So. Cov. & Cin. St. Ry.........2d mtg. 6s.	400,000	400,000	1932	J. & J.	132¾	137

† Assumed by the Cincin. St. Ry. Co.

‡$250,000 reserved to retire 1st mtg. bds.

Cleveland O.

Date of Quotation—Aug 26, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co.......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106½	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	113½	114⅛
Cleveland City Cable Ry.....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	105½	106
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1918	M. & S.	106	107
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	......	......
aEast Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	......	107½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.

‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Aug 26, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry......1st mtg. 5s.	7,000,000	3,385,000	1905	A. & O.	......	102½
Ft. Wayne & Belle Isle Ry....1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry....................1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	105	106½

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Aug 26 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St Ry............1st mtg. g. 5s...	600,000	600,000	1918		111	....
New Haven, Edgewood Div., 1st mtg. 5s.	250,000	250,000	1914	J & D	111	......
Winchester Avenue RR., 1st mtg. g. 5s..	100,000	500,000	1912	M& N	109	......
Winchester Avenue RR..... Deben 5s.	100,000	74,000	1919	M& S		....

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation—Aug 26 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.... cons mtg. 6s.	$150,000	$150,000	1912	M. & N.	......	...
Crescent City RR..............1st mtg. 6s.	......	50,000	1899	M. & N.	105⅛	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1948	J. & J.	......	.....
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1908	J. & D.	108	112
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	112	113
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	......	......
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	......	......
‡St. Charles St. RR. Co.......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	......	......

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.

‡$90,000 outstanding.

New York.

Date of Quotation—Aug 26 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn).....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	......
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107⅛	110
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,965,000	1931	A. & O.	115	116
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	123	125
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	10
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	108	110
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	111
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	115	116
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	101	....
Brooklyn Heights RR.......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	......
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	112	....
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	107	....
Brooklyn Rapid Transit..........gold 5s.	7,000,000	5,181,000	1945	....	109⅛	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	98⅛	106
Cent P'k, N. & E. R. RR. 1st cons. mtg. 4s.	1,200,000	1,200,000	1902	J. & D.	107	109
Central Crosstown RR.........1st mtg. 6s.	250,000	250,000	1922	M. & N.	125	......
Coney Island & Brooklyn RR. 1st mtg. 5s	800,000	800,000	1903	J. & J.	101	108
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1932	J. & D.	117	120
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	100,000	1,100,000	1914	F. & A.	102	105
Eighth Av. RR. Co.....Cert. indebt. 6 %.	000 000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	,200,000	1,200,000	1910	M. & S.	116⅛	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	89	......
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	124	125
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	120	......
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600 000	1909	M. & N.	120	121
Second Avenue Ry..............Deb. 5s.	800,000	800,000	1909	J. & J.	108⅛	109
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	116	117
South Ferry RR. Co............1st mtg. 5s.	850,000	850,000	1919	......	110⅛	112
Third Avenue RR............1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	......	128
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	.....	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	106	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	118	116
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	114

†$1,085,000 in escrow to retire gen. mtg. bonds.

‡$4,850,000 in escrow to retire maturing obligations.

¶$552,000 in escrow to retire 1st and 2d mtg. bonds.

§In treasury, $80,000.

‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Aug 26 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.......................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	...
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M & S.	....	...

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—Aug 26, 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry......................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1948	...	....	....
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J &	......	....
Philadelphia Trac. Co.........Coll. tr. g. 4s.	1,800,000	1,018,000	1917	F. & A.	......	.....
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...............Col. tr. 4s.	29,785,000	29,724,876	1945	A. & O.	——	.....
West End Passenger Ry.......1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	......	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	......	......

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Aug 26 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	111⅛	....
Central Traction Co................1st mtg. 5s.	875,000	875,000	1930	J. & J	......	......
Citizens' Traction Co..............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co..........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	.....	......
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg...............5s.	750,000	750,000	1928	M. & N.	110	113
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	113
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co.......................5s.	2,500,000	2,039,006	1934	J. & D.	......	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1912	M. & S.	......	....

Providence R. I.

Date of Quotation—Aug 26 1901

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	116	118

St. Louis.

Date of Quotation—Aug 26, 1901.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baden & St. Louis RR.........1st mtg. 5s	250,000	250,000	1913	J & J	101⅛	.....
Cass Ave. & Fair Gds Ry......1st mtg. 5s	1,818,000	1,818,000	1912	J & J	101⅛	......
Citizens' Railway Co.......1st mtg. 5s	2,000,000	1,500,000	1907	J & J	109	
Comp. Hts. Un. De. & Mer. Ter.—1s	1 000 000	000 000	191	J& J	17	

* With interest   † Unlisted

* With interest

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Aug 26 1901.						
Jefferson Avenue Ry............1st mtg. 5s.	270,000	270,000	1905	M. & N.	102	118
Lindell Ry. Co........................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	108
Missouri RR. Co....	1,000,000	700,000	1916	M. & S.	105	106
‡Mound City RR. Co...............1st mtg. 6s.	400,000	300,000	1910	A. & O.	104½	105⅛
People's RR. Co.......................1st mtg. 6s.	125,000	125,000	1902	J. & D.	....	.....
∥People's RR. Co......................2d mtg. 7s.	75,000	75.000	1902	M. & N.	......	......
People's RR. Co..................Cons. mtg. 6s.	1,000,000	800,600	1904	J. & J.	......	......
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.........................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	99⅞	100⅛
‡St. Louis & Sub. Ry..........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry...................Income 5s.	300,000	300,000	......	....	80	84
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	106	108
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1912	J. & J.	116½	117½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	100	100⅝
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	121	122
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
∥$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Aug 1901.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,600	1915	J. & J.	114	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	117
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	......	95
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	126¾	......
†Metropolitan Ry. Co...................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126¼	......
†Park & Cliff House RR........1st mtg. 6s.	350,000	350,000	1912	J. & J.	105¼	107
†Park & Ocean RR.................1st mtg. 6s.	250,000	250.000	1914	J. & J.	115	......
†Powell St. Ry.........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	125
Sutter St. Ry. Co..................1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Aug 26 1901						
Belt Ry. Co.............................Cons mtg 5s.	500,000	450,600	1920	J. & J.	......	...
Columbia Ry...............................1s mtg. 6s.	500,000	500,000	1914	A. & O.	122	......
Eckington & Soldiers' Home.1st mtg. 6s.	200,000	200,000	1911	J. & D.	......	......
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	......	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Aug 26, 1901						
Bridgeport Traction Co.........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	108	110
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	118	. ..
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	104	105
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,866,000	1932	M. & N.	112	113
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	115	....
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	111¼	111⅝
∥Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	115	115⅝
Denver City Cable Ry.........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	20	..
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	85
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	119	119¼
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	110¼	110¾
††No. Hudson Co. Ry. (N.J.).Cons. mtg. 5s	3,000,000	2,878,000	1928	J. & J.	108	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.).......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	....	......
Rochester (N. Y.) Ry.............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	......	......
St. Paul City Ry......................Cons. g. 5s.	5,500,000	4,298,000	1937	....	105¼	106
St. Paul City Ry........................Deb. g. 6s.	1,000,000	1,000,000	1900	....	103	....
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. St. RR. Co.						
∥$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int're	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked
Boston, Mass.						
Date of Quotation—Aug 26, 1901.						
Delaware Gas Lt. Co.,.........1st m. 5s, g.	800,000	800,000	......	J. & J.	106	108
Edison Elec. Illuminating Co., Boston...	2,026,000	......		Quar.	157	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	116	......
Pittsburg Pa						
Date of Quotation—Aug 26. 1901						
Allegheny County Light Co................6s.	500,000	......	1911	J. & J.	110	......
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Aug 26 1901.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	109	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	124	......
Edison Elec. Illg. Co. (Brooklyn).......	5,000,000	5,000,000	1940	....	122½	124
Edison Electric Light (Philadelphia)..	2,000,000	......	....	.....	. ..	......
Kings Co. El. Lt. & Pow. Co. 1st mtg. 5s.	2,500,000	......	1937	A. & O.	100	105
Kings Co. El. Lt. & Po. Co. pur. money 6s	5,176,000	....	1997	A & O.	120	122
Milwaukee El. Ry & Lt. Co. 1st con. g. 5s.	8,000,000	....	......	F. & A.	102½	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked
Miscellaneous.						
Date of Quotation—Aug 26 1901.					109⅛	101
American Bell Telephone.....................4s.			1908	F. & A.	......	....
Northwestern Telegraph Co................7s.	....	......	....	......	....	......
N.Y. & N.J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	114	115
Chesapeake & Potomac Teleph. Co....5s.	....	......	1911	J. & D.	106	106

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked
Miscellaneous.						
Date of Quotation—Aug 26 1901						
American Electric Heating............. 7s	500,000	500,000	....	....	....	......
Armington & Sims Engine Co..............	....	....	......	......	......	25
Barney & Smith Car Co......................6s.	....	....	1942	J. & J.	106	107
Carborundum Mfg Co.........................6s.	....	....	1904	J & D.	......	......
Worthington Pump Co........................	75,000	....	......	....	115	127

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 16⅝@16⅞c.; Lake, 16¾@17c.; casting, 16½@16¾c.

The New York and Queens Electric Light and Power Company has increased the number of its directors from 7 to 9.

The receipts of the National Carbon Company, so far in the fiscal year, show nearly 3 per cent. earned on the common stock.

July earnings of the Electric Company of America are reported as showing an increase of 20 per cent. over the same month last year.

The annual meeting of the Philadelphia Union Traction Company will be held September 18. Books close August 28 and reopen September 19.

There is a persistent rumor that the Metropolitan and South Side Elevated Railroad Companies of Chicago will be consolidated within a brief period.

Net receipts of the Philadelphia Electric Company for the six months ended June 30, 1901, it is said, show an increase of about $50,000 to $60,000.

The Everett-Moore syndicate is trying to buy the Wheeling (W. Va.) Traction Company, offering nearly 150. The company has good Ohio connections.

The Edison Electric Company of Los Angeles, Cal., has bought the California Power Company and combined with the Power Development Company of Bakersfield, Cal.

Philadelphia Union Traction got up to its highest figures on Monday since the scare over the franchises recently granted to the Foerderer syndicate, opening at 29 and closing at 30½.

The St. Lawrence International Electric Company, of Alexandria Bay, N.Y., has certified to the Secretary of State that its capital stock has been increased from $40,000 to $250,000.

The receipts of the Toronto (Ont.) Electric Street Railway for last month were $150,620, of which the city gets $15,626. For the same month, four years ago, the receipts were $103,670.

A large consumer of copper is quoted as saying that "this is the banner year for the consumption of copper in the United States. It is easily 33⅓ per cent. larger than in any previous year."

Chicago Union Traction officials declare that the showing made for the first half of the current month indicates that the gross earnings for August will show an increase of $6,000 over those for the like period last year.

The Twin City Rapid Transit stock is active and strong in Toronto. Friends of the stock say it will cross Toronto Railway stock, which now sells at 111. Attention is called to the fact that both issues get the same dividend.

The United Railways Company of Baltimore gives a notice to the holders of the Baltimore Traction extension and improvement 10 year 6 per cent. bonds that these bonds will be paid September 1 at the office of the Mercantile Trust and Deposit Company.

The following are quotations for some of the industrial stocks not quoted elsewhere: Electrical Lead Reduction, 1½@1⅝; Electric Boat, 19@22; Electric Vehicle, 5½@7; Tel. & Tel. Company of America (full paid), 3@5; Electric Company of America, 7¼@7½; National Carbon, 17½@17¾.

The Chicago Telephone Company has declared the regular quarterly dividend of 3 per cent., payable October 9. Books close September 26 and reopen October 9. Stockholders of record September 26 will have the privilege of buying on October 9 at par pro rata to their present holdings of stock $1,000,000 of the new stock to be issued.

The Schenectady Railway Company, controlling the entire railway and electric lighting business in Schenectady, N. Y., all of whose stock is owned by the General Electric Company, has built a double-track extension to Albany and has in course of construction a line to Troy. Other extensions are also in contemplation, which, with those mentioned, will make a property of considerable magnitude. Funds for the extensions are to be provided by an issue of $1,250,000 first mortgage bonds, which have been sold to Messrs. N. W. Harris & Co., bankers of this city.

The motion to make William G. E. See permanent receiver for the General Carriage Company of New York came up before Vice-Chancellor Stevenson at Jersey City Monday, but was laid over until Tuesday, September 3, on the application of Counselor Stebbins, who represented a creditor. Peter Bentley, counsel for the creditors, asked that Orlando Thomas, treasurer of the company, be made the permanent receiver instead of Mr. See. Charles L. Corbin, counsel for the company, said he had no objections, but Mr. Stebbins said he wished time to consult his clients. The principal business of the company was the manufacture of electric vehicles.

During the past two weeks the stock of the Amalgamated Copper Company has advanced steadily on the New York Stock Exchange from 100 to 121. This is attributed in many financial quarters to rumors of a comprehensive combination of the copper producing interests of the United States. There would seem, however, to be no good authority for the rumor and some other cause will therefore probably have to be sought for to account for the rise. Referring to the rumor of a consolidation a well known independent copper man is reported as saying: "I only hope that the rumor is true that there is to be a copper combination. It will mean much easier sailing for us. There is strength enough outside of the companies, that are supposed to enter the deal, to make the situation interesting for them and they certainly cannot buy up all the copper producers of the world, especially as the field is growing so rapidly. The market is more adapted to smaller concerns and such a combination as is proposed could not last out a long, dull market. I certainly do not expect to see the company ever materialize."

ELECTRICITY.

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EDITORIAL NOTES.

The Telephone, Telegraph and Cable Company of America to be Sold

The road leading to independent telephony in New York City would seem to be as rough a one to travel as that reputed leading to Jordan. During the past two years the Knickerbocker Telephone, Company which is controlled by the Telephone, Telegraph and Cable Company of America, has been gradually gaining a foothold on the outskirts of the metropolis, and just as the public began to congratulate itself that telephone competition for this city was in sight the announcement is suddenly made that the Telephone, Telegraph and Cable Company of America, which was incorporated with a capital of $30,000,000 under the laws of New Jersey on November 9, 1899, is about to be sold for $2,000,000 to Mr. C. W. Morse, of the Garfield National Bank.

In a circular letter to the stockholders of the company President Thomas says:

"The Board of Directors of this company are in receipt of a proposition from Mr. C. W. Morse, of New York, to purchase from each stockholder all of his holdings at 50 per cent. of the actual amount that each one has paid in. This purchase is conditional upon at least two-thirds of the total number of shares issued and outstanding being delivered to the City Trust Company of New York, No. 36 Wall street, New York City, on or before September 10, 1901.

"Stockholders desiring to avail themselves of this offer should forward their stock at once. This stock will be held by the City Trust Company of New York pending an examination of the affairs of the company and also pending a verification of the assets of the company, consisting principally of stocks and bonds owned in other corporations.

"As soon as this examination has been completed, payment will be made in cash for the stock so deposited. The Board of Directors, realizing the necessity of expending a very large amount of money to put the company in operation, and a large number of stockholders not being willing to advance additional funds, recommend to you the acceptance of the above proposition."

As will be seen by the circular there is evidently a lack of funds to carry out the proposed plans. At the present time the Telephone, Telegraph and Cable Company of America at an expenditure of $9,000,000 has arranged for the building of trunk lines between this city and Boston, which will probably be ready for use at the end of a year or two. Since the offer of Mr. Morse, which was made about ten days ago, the boards of directors of the various subsidiary companies of the Telephone, Telegraph and Cable Company of America have held meetings and approved of his proposition. Last week the directors of the present organization were brought together with the result that the circular, as quoted above, followed.

There have been three assessments called for on the subscribers to the stock of the Telephone, Telegraph and Cable Company of America, each of which was for $5. Some of the stockholders have not, thus far, made any payment on the second and third assessments. The amount thus far paid in is about $4,000,000, and it is half of this that Mr. Morse now proposes to pay, provided he can obtain all or two-thirds of the entire stock issue. Another proviso is that the assets of the company, after an investigation, will turn out to be as has been represented to him.

Referring to the subject Mr. Morse is reported as saying:

"It is true that I have made an offer to purchase the company as set forth in the circular you have. I believe that there is plenty of room for healthy competition in the country in the telephone business, and I'm willing to assume the risk. The company controls very valuable franchises, and has its wires in the subways of this city. I am assuming the responsibility as an individual, and there is absolutely nothing of a political character about it.

"When a stockholder has only paid in $5 I will pay him or her $2.50, where it has been $15 then I will pay $7.50, and so on. It is purely a business proposition on my part, and if an examination of the company shows its assets to be what I understand they are and the stockholders deposit their stock on the terms I have offered, the company will pass into my control. That is all I care to say at the present time."

In view of the fact that healthy competition has been the means of reducing telephone charges in such cities as Detroit, St. Louis, Indianapolis, Cleveland, Columbus and elsewhere, it is to be hoped that sufficient funds will be forthcoming one way or another to permit of a first-class independent company gaining a solid foothold in the near future in New York City.

* * *

The Fender Question for Broadway Cars.

It is stated that since electricity has replaced the cable as motive power on the cars running up and down Broadway of this city that the number of accidents to pedestrians has been on the increase.

The question has been raised as to why fenders such as are made use of in Brooklyn are not adopted, but in reply it is urged that fenders will not last even for one round trip, owing to the density of the traffic, more especially in the down town district. President Vreeland, of the Metropolitan Street Railway Company, referring to the subject recently said:

"I have given the fender my personal attention, and I can assure you that no Broadway car equipped with a fender ever made a round trip without an accident. In the lower end of Broadway it becomes necessary to force our cars through a mass of the heaviest kind of traffic. Truck drivers have respect for a car only for the reason that they know that a collision would damage their wagons, but they will cut cross in front of a car in such a manner as to crush the fender. The result would be a never ending blockade below Canal street. It is impossible to remedy this evil.

"While accidents have increased in number in Broadway since the electric cars were introduced, there has been no increase in accidents owing to the absence of fenders. The Broadway public has not yet accustomed itself to the new cars. They start and stop much more abruptly than did the cable cars, and there has been a great increase in the number of accidents from this cause. Women are particularly awkward in this respect. It seems to be impossible to educate them to wait until the car stops before attempting to get on it or to step off. Then, too, they back off the car, and if there is the least bit of motion they fall.

"There is still another cause for the increase of accidents that has never been mentioned in the newspapers, but is shown in our records. I refer to the laying of asphalt pavements in Broadway. Above Fourteenth street there is not a recognized street crossing in Broadway. When the stone pavement was in use there were smooth crossings at each corner.

"Persons then seldom attempted to cross the street except at the corners, where they were protected by the policemen and where the cars were slowed down a trifle. Now they cross at any point that happens to suit their convenience. They dodge past one car, and often find themselves almost under the wheels of a car running in the opposite direction. No policeman is at hand. If you will question the motormen they will tell you that their work is greatly multiplied since the asphalt pavement was put down."

Regarding the fender question, President Vreeland is reported as saying that he is open to suggestions, and if such is the case it would certainly seem as though a guard of some sort might be devised which could be placed under the forward projecting end of the car in such a way that no vehicle could break it off and yet at the same time prevent a person who has been knocked down from being crushed by the wooden guard or wheels. In this hint possibly some of our readers may find food for thought.

* * *

American Electrical Machinery in Brazil.

Electrical machinery of American manufacture is gaining a strong foothold in Brazil, the exports in this line having increased from $58,846 in 1898 to $77,777 in 1899, and still further to $87,058 in 1900. Even greater gains are to be noted in the exports of scientific instruments and apparatus, telegraph, telephone and other electrical appliances, the value for 1898 being $88,233, increasing to $113,981 in 1899, and to $222,137 in 1900.

Electrical firms wishing to do business with Brazil need first to study the market and become acquainted with its wishes and peculiarities. A good traveler, who can speak Portuguese, is worth more than a ton of circulars or catalogues, which are seldom read when printed in Portuguese, the language of the country, much less when in English, which is unknown. It is surprising to see that some of our largest firms do not realize these facts. It is necessary that commercial travelers going to Brazil should study the tariff, and be able to give a merchant some idea as to what probably would be the classification of the goods which he is representing. He should also be able to keep his firm advised as to the best methods of invoicing, packing, etc., to facilitate entry. It is true that one can never tell just what duty many things will pay, as the classification frequently varies, and is often arbitrary. The importer is required to know the proper custom house classification when he applies for entry, and if he declares an article under a classification other than that in which it subsequently passes the inspector, he is subject to double duties and a fine of 10 per cent. as well. To guard against this, it is said that the Rio clerks of commercial houses are about to establish a museum of samples which will show the accepted custom house classification, and arrangements are to be made to keep pace with the daily rulings. This will be of great benefit to Rio de Janeiro, but other points will suffer as usual. The more remote a port of entry is from Rio de Janeiro, the better it is to pay duties and fine, and withdraw the goods, and subsequently take the case to Rio, as there are always months of delay and a great deal of trouble and expense attending appeals.

Commercial travelers should know that it greatly expedites dispatch upon entering the country to have a complete list showing name and classification by tariff of each sample they carry, upon which, if worthless, a small tax is assessed to cover expenses of examining, and if considered of value, duty is paid. Goods once dispatched from any custom house, it is well to carefully preserve a copy of the complete list furnished the custom house, together with its receipt for the dispatch of the same.

In reply to the question, "How can our export trade with Brazil be further developed?" the following answer naturally suggests itself: By the establishment of international banking facilities based upon a currency of undoubted stability; by controlling means of transportation; by manufacturing that which is most suitable for the needs of the Brazilians; by intelligent legislation, commercial treaties, and bright and active representation in the large cities of the republic.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

Mr. C. A. Coffin, president of the General Electric Company, sailed last week for Europe. He is expected home October 1.

It is reported that Mr. Bion J. Arnold of Chicago will superintend all the electrical work of the New York Central Railroad Company.

The Street Railroad Association of the State of New York will meet in Rochester September 10 and 11.

Mr. Thos. A. Edison has returned to work in his laboratory after a six weeks' vacation in Buffalo and Chatauqua.

It is claimed that the manufacturers of electrical apparatus are pleased at the growth of the Scottish demand for generators and other American electrical machinery for central power stations, coal mines and various other purposes.

The 17th annual meeting of the Edison Illuminating Companies will be held at the New York State Building, Pan-American Exposition Grounds, Buffalo, September 10, 11 and 12. Papers will be read by the following gentlemen: A. S. Knight, Boston; John F. Gilchrist, Chicago; Wallace Clark and Caryl D. Haskins, Schenectady; Luther Stieringer and Arthur Williams, New York City; F. W. Willcox, Harrison, N. J., and a paper is expected from Charles P. Steinmetz. The Association will be the guest of the Buffalo General Electric Company.

Plans for the interiors and entrances for the City Hall and 28th street and Fourth avenue stations of the Rapid Transit Underground Railroad in this city have been completed by Heins & La Farge, architects, of No. 5 Beekman street, and work on the drawings for the other stations is in progress. There will be 48 stations in all, those at which the express trains will stop being City Hall Park, Union Square, East 42d street, Broadway and 72d street and Broadway and 96th street. On the average they will be 1¼ miles apart.

Arrangements have been practically completed for the run of the Chicago Automobile Club to the Buffalo Exposition. After a careful study of road charts and maps, those who are planning the route made known the schedule that will be followed: The start will be made on Saturday, September 7. The automobilists expect to cover 571 miles in eight days. Indications at present are that 30 automobiles will start.

The electric light wire of the Stratford, Conn., Congregational Church had become disarranged by a recent storm, and the circuit was broken. A gentleman in the congregation whose automobile was in a shed near by went to the shed and ran the vehicle out close to a rear window, just behind the pulpit. He then connected the main feed in the church with the powerful storage battery of the machine, and turned on the power. Instantly the interior of the church was brilliantly lighted.

L. M. Ericsson, Miss Ericsson, G. Piltz and Frank T. Cedergren of Stockholm, Sweden, will spend considerable time in examining the electrical exhibits at the Pan-American Exposition. The men in the party are all electricians and are interested in the Swedish Electrical Company of Stockholm, manufacturers of electrical machinery.

PAN-AMERICAN SCENES AND EXHIBITS—VIII.

BY FRANK C. PERKINS.

It is a very pleasing trip to ride on the electric launches or gondolas through the Grand Canal at the Pan-American Exposition and the visit to the streets of Venice, with its festoons and arches of colored incandescent lamps is not soon forgotten. The accompanying illustration, Fig. 1, is a street and canal scene by day in the Venetian Village.

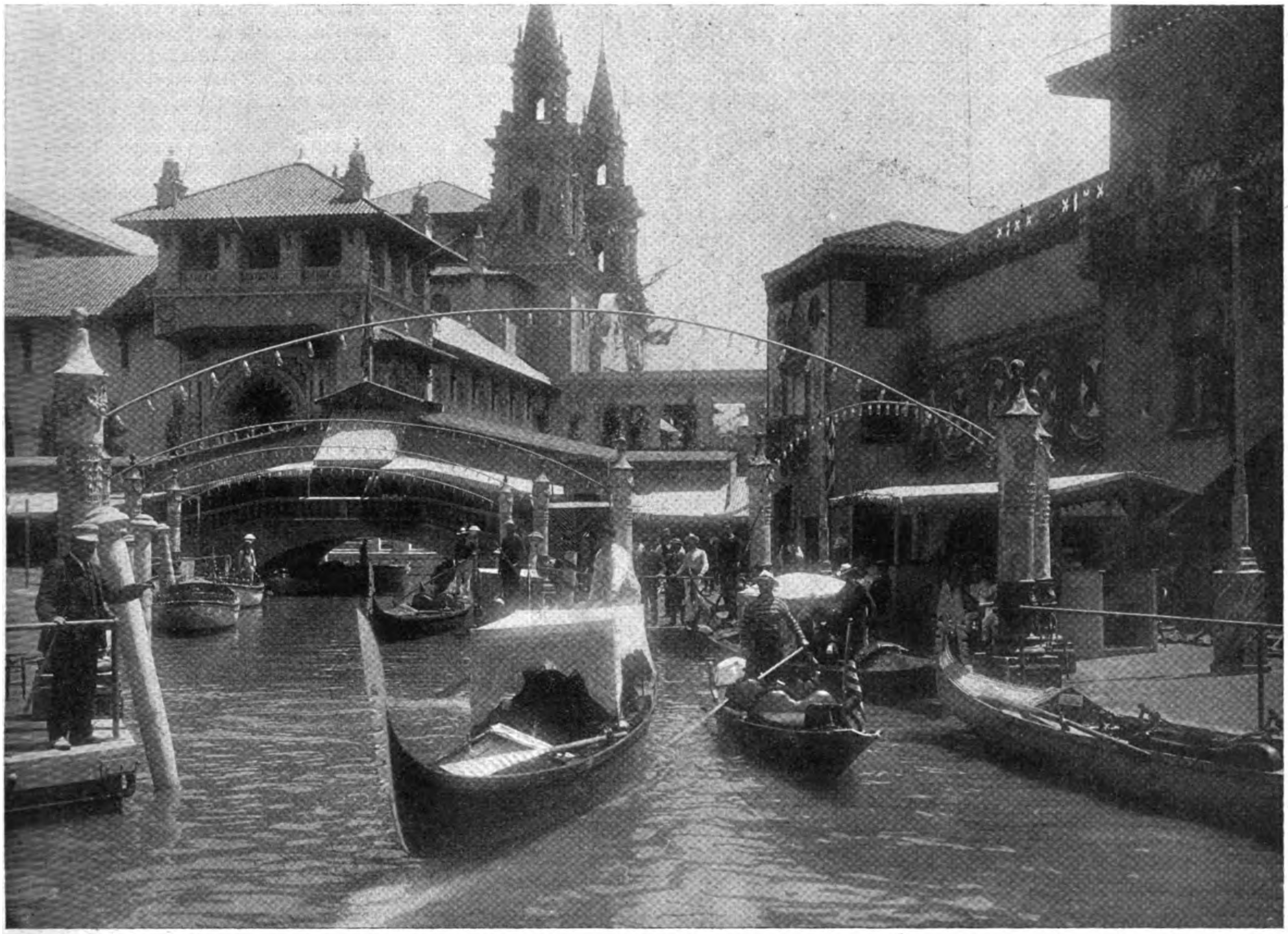

FIG. 1.—ELECTRIC ARCHES, ELECTRIC LAUNCHES A GONDOLAS IN THE STREETS OF VENICE, PAN-AMERICAN EXPOSITION.

The exhibit illustrated in Fig. 2, showing the use of cling-surface is located in the Machinery Building and was devised and installed by Floy and Carpenter, of New York. It is arranged to show the ordinary conditions of belt transmission and to give a variety of comparisons and tests under various conditions, illustrating the effects of cling-surface upon belting under severe use. The exhibit consists of a 10 hp. motor of Westinghouse make, driving from a double pulley made from a single casting, two 5 hp. Westinghouse generators, two 4 inch leather belts being used, one having been treated with cling-surface, while the other operates as delivered by the maker. The two generators are mounted upon movable trucks, attached to spring balances, arranged to show the initial and working tensions on the belts. The belt treated with cling-surface is under an initial tension strain of 50 lbs., and when loaded runs so slack that the top side barely clears the lower or driving side, while the untreated belt is under a strain of 144 lbs., and runs tight on both sides. Two banks of 10 cp. incandescent lamps are seen in the illustration for loading the generators, 100 lamps being mounted in each bank. A field rheostat and double throw switch is installed for each dynamo, which may be loaded with either bank of lamps, a separate voltmeter and wattmeter being supplied to each circuit. With rheostats equal and belts under tension, as above described, the slack belt lights its 100 lamps brilliantly while the tight belt will only light its 100 lamps a faint red, and only 20 lamps can be lighted equal to 100 lamps of the slack belt. The variations in speeds and voltages are also noted.

Gold Medal for Rustin.

Henry Rustin, the electrician who designed and achieved the Pan-American illuminations which have excited unstinted praise, will be rewarded for his work. The superior jury of awards has decided unanimously to give him a gold medal in recognition of his grand achievement.

NOTES ON MODERN ELECTRIC RAILWAY PRACTICE.[*]

BY ALBERT H. ARMSTRONG.

During the past few years electric traction work has been passing through a transition period outgrowing the restricted limits of city surface traffic and encroaching upon a class of work hitherto accomplished with the steam locomotive. The broadening of the electric traction field has necessitated considerable development in the motive power, and the transmission and connection of electrical energy, and it is the purpose of this paper to briefly review some of the more important problems in electrical traction now in course of installation or under serious discussion.

The first case to be considered is the small city railway where 500-volt direct current generation and distribution amply suffices. As the system grows and the demand for suburban service increases, it becomes necessary to install either a large amount of feeder copper, a booster, or a storage battery. All of these expedients to take care of the suburban load are temporary, however, as they do not possess inherent qualifications sufficient to care for a rapidly growing system. There is a limit to the amount of feeder copper that can be economically installed; the booster if used continuously brings the coal consumption up to a prohibitive figure; and the storage battery is not adapted for an expanding system, and furthermore cannot successfully take care of long sustained overloads at the end of a suburban line fed from a city system.

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[*] Paper read at the 18th Annual Convention of the American Institute of Electrical Engineers, Buffalo, N. Y., August 24, 1901.

Transmitting energy by alternating current affords a means of feeding a large territory from a single generating station, but in the case of a small city road the amount of alternating current required is a small proportion of the total generating station capacity, the bulk of which calls for 500-volt direct current. The best method of meeting this demand for surburban service is therefore to install in the d. c. generating station a standard rotary converter operated from the d. c. bus bars as an inverted machine, and feeding a similar machine at the objective point by means of step-up and step-down transformers. The advantage of this method of generation is that both machines may be used as converters later on when the suburban load has increased sufficiently to warrant the installation of alternating current generators, replacing the direct current machines in the city station. Double current generators may be used, furnishing direct current for local consumption and alternating current for distribution purposes, but the installation of such machines presupposes that the ultimate load will be approximately evenly divided between the d. c. and a. c. output. It is probable, however, that the a. c. output will increase in a much faster ratio than the d. c. with its restricted area of distribution, so that double current machines do not afford the same convenience for taking care of future growth as do standard alternating current generators furnishing alternating current only.

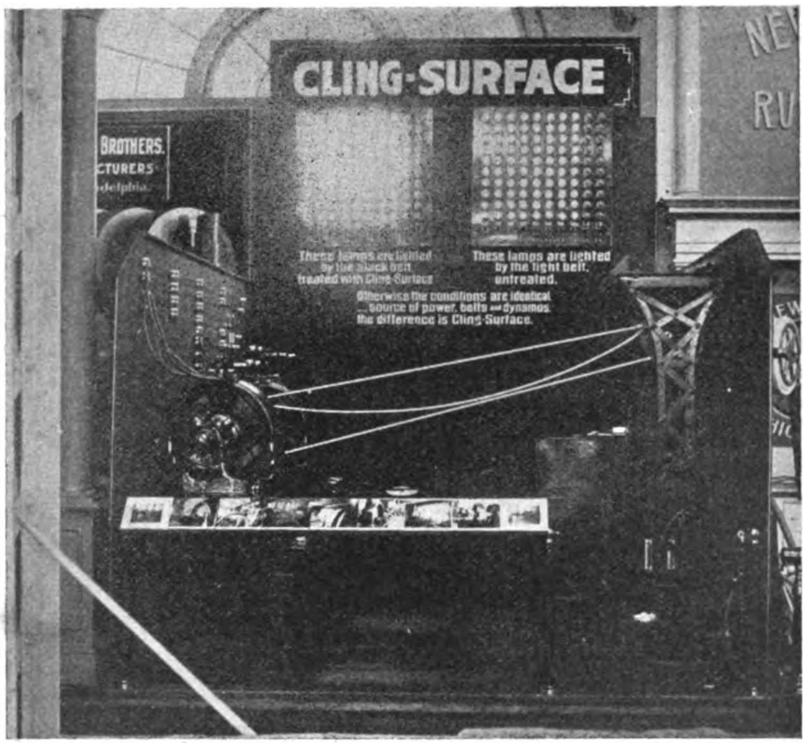
CLING-SURFACE
BROTHERS
TURERS
delphia
These lamps are lighted by the black belt treated with Cling-Surface
These lamps are lighted by the light belt, untreated.
Otherwise the conditions are identical ... source of power, belts and dynamos. the difference is Cling-Surface.

Fig. 2.

Exhibit of Cling-Surface Company of Buffalo, N. Y., at Pan-American Exposition.

The direct current system of generation, even for city distribution, becomes greatly handicapped with the continued growth of the city, owing to the large amount of power to be transmitted and the wide area which the city covers with its probable efficient street car service, thus relieving congestion in the center of the city. The alternating current generating station with substations scattered throughout the city appears to be the trend of the city distributing systems even where suburban connections do not exist, and where such suburban extensions do exist, all arguments point still more to the alternating current as the proper method of generating and distributing railway power.

One great advantage of the alternating current lies in its affording a means of consolidating adjacent roads under one system of generation and distribution; indeed, the alternating current is a prime factor in such consolidations, as it effects a large saving in operating expenses by doing away with the many small direct current stations required with the local 500-volt d. c. power houses.

The above discussion considers primarily the city surface road with suburban extensions running at moderate speed and operating cars of moderate weight, say, fifteen to eighteen tons. The growth of such a system in this country has been, first, the installation of d.c. operating apparatus, then the motor or engine driven booster, followed by the inverted rotary converter with alternating transmission, and finally, as the system expands, a large generating station containing high-tension alternating apparatus with several rotary converter substations suitably located to take care of the various parts of the system.

There is another class of railroads which differs in many points from the ordinary city lines, and included in this list are the elevated and underground rapid transit roads. The problem presented here is the operation of trains of two to six cars, weighing from 50 to 150 tons, at schedule speeds ranging from 13 to 16 miles per hour, with stops averaging from three down to two per mile. These roads operate on private right of way, stopping at designated stopping points, and are not influenced in any way by the surface traffic of the city streets.

The motive power to operate these trains at high schedule speeds and with frequent stops must be so designed that it can give an enormous torque during acceleration, and the controlling apparatus must provide for the efficient handling of these motors during fractional speed running. The problem becomes one of carefully determining the proper motor characteristics for efficient acceleration, and a proper motor design so that unsafe temperatures will not be reached from repeated temporary overloading of the motors.

Direct current has been generally used for such work, while the system of transmitting the electrical energy is in a transition period, but gradually changing over to the older installations and being installed in the newer installations as alternating current generation with rotary converter substations operating at 600 volts d.c. The reasons are the same as those influencing the change of the generating station operating surface lines—the inability of a single direct current generating station to feed the large systems in operation with a reasonable amount of feeder copper, and the reduction in operating expenses resulting from replacing several d.c. stations with a single a.c. station well located.

The d. c. series motor seems particularly well adapted for the propulsion of rapid transit trains running at variable speeds. Of the total input to the train a properly designed motor equipment will give out over 70 per cent. as useful work at the car wheels—that is, all the losses occurring in the motors and in the controlling apparatus are less than 30 per cent. of the total energy input to the train.

Where the runs are longer, and the train is permitted to run for some distance at full speed, the losses are of course considerably less; but even with the frequency of stops ruling in our elevated roads, the "efficiency of acceleration," so-called, is very high. This high efficiency of acceleration is due to the fact that direct current series motors can accomplish a considerable part of the acceleration of a train on the motor curve with starting resistances entirely cut out and motors operating with full line potential. This part of the acceleration curve may be made at an efficiency of over 85 per cent., thus making up for the starting resistance losses while the motors are running at fractional voltage. In making the above efficiencies of acceleration it is understood that the series parallel controller is used. A slightly better efficiency of acceleration is obtained by a series parallel controller provided for starting with four motors in series, changing to two in series, then all in multiple; but the complication of this controller is not warranted by the one or two per cent. higher efficiency obtained with it.

Elevated and rapid transit roads within the cities are built along the following lines: A single alternating current generating station well located with respect to cheap fuel and water, a transmission line consisting of underground triple lead-covered cables leading to substations suitably located with regard to the load, and operating at 600 volts d.c., a d.c. distribution system consisting of third rail and track return with feeders of either copper or rail, if required, and finally direct current series motors mounted either upon a locomotive or motor car, and controlled by a single controller or distributed throughout the train and controlled from a system of train control.

There is a new class of railways which is becoming the center of great attention. These are high speed interurban, or cross country lines of considerable extent. These lines operate on private right of way, are carefully graded, have few sharp curves and operate cars weighing from 30 to 40 tons at schedule speeds as high as 40 miles per hour, including stops at every three miles or more. These roads are paralleling the steam roads and make the same schedule speed as the steam roads provide, with the additional benefit of more frequent stops. Owing to the great tractive effort provided with motors connected to each axle, trains electrically driven can accelerate much faster and hence maintain the same schedule with more frequent stops than it is possible to accomplish with steam locomotives.

These interurban lines operate their cars through the city streets at the termini, thus picking up and discharging passengers at the most objective points and thereby making them still keener competitors of the steam railway systems. Owing to the high speed of these heavy suburban cars and the necessity for fairly rapid acceleration, each car or train unit will demand a considerable current when starting up. This current may reach 400 to 600 amperes per car, falling to 150 to 200 amperes per car when running at constant speed of 50 miles per hour, or more. Some interurban roads are being installed contemplating a maximum speed of nearly 70 miles per hour, so it is evident that the motors as well as the distributing system must be so designed that they can take care of enormous fluctuations in load. As these interurban systems are now being installed with 100 miles or more of track, the advantage of alternating current distribution at high potential is evident, and this method of distribution is universally used. Substations are located at intervals of 10 to 15 miles, and may or may not be equipped with storage battery auxiliaries. The storage battery effects a more uniform load curve on each individual substation, but the effect of such storage battery auxiliaries upon the generating station load curve may be quite small, due to the number of substations fed from a single generating station. A single alternating current generating station operating at 26,000 volts can feed the territory lying within 50 miles radius of the power house, and the load thus secured, although violently fluctuating at the individual substations, is greatly smoothed out when the resultant load of the several substations is read upon the generating station bus bars.

In interurban work the direct current series motor shows itself to be capable of taking care of the widely different demands placed upon the motive power. For instance the cars must be able to run for long distances at full speed with infrequent stops, but must also be capable of operating over city streets at city schedules with the stops six to ten per mile customary in city work. The series parallel control of motors is of course a considerable help, as it permits half-speed running with motors in series, but even this half speed may be too high for city work, thus calling for considerable rheostatic control with motors in series.

Although great care is taken in laying out suburban roads to keep down the grades and eliminate the curves as far as possible, still the grades may be heavier than would be permissible with steam locomotive propulsion, owing to the greater traction provided with electrically propelled cars. The characteristic of the series motor, which permits it to slow down on grades and speed up on levels, is therefore very valuable in this kind of service, as it reduces the fluctuations upon both the motive power and the distributing system.

The qualifications of the direct current series motor for interurban work have been entered into at some length, as there is another method of electrical distribution coming into notice—alternating generation and transmission, and alternating induction motors upon the cars. The system consists in brief of a multiphase generating station feeding into transmission wires extending along the line of travel, feeding at frequent intervals into step-down transformers which reduce the transmission potential to a still considerable pressure for the overhead trolleys. Induction motors receive their power directly from these trolleys and are geared to the car axles by the standard method.

(To be continued).

PERFORMANCE OF AN ARTIFICIAL FORTY-MILE TRANSMISSION LINE.*

BY WILLIAM S. ALDRICH AND GEORGE W. REDFIELD.

The artificial duplication and test of a 40-mile transmission line was carried out as far as facilities would permit in the Electrical Engineering Laboratory of the University of Illinois during the Spring semester of 1901. The combinations selected were such as would cover a wide range of conditions in practice. The results obtained represent closely those that might be expected under commercial conditions of a similar line. The characteristics of performance illustrate the evil effects of shifting phase displacement as the chief cause of poor regulation.

General Considerations and Requirements.—The kind of service and requirements at the receiver end of the line involve a consideration of the kind of load, such as synchronous motors or converters, induction motors, arc and incandescent lights, or any combination of these. In the design of the line the prime factors are load, distance, voltage, frequency and allowable drop and loss. There is usually allowed a maximum drop for the given conditions. Such an allowance depends upon the kind of service employed, the character of the load and the inherent properties of the line, such as ohmic resistance, self-inductance, capacity, frequency, line current and its phase displacement.

The character and variation of receiver loads also largely influence the line regulation, losses and efficiency. The voltage, cost of conductors, cost of construction and maintenance and insulation to prevent leakage deserve some share of consideration.

The energy or I^2R loss in the line, in per cent. of the full load power delivered to the line, usually varies between 5 and 10 per cent., in the best modern transmission installations. The charging current and receiver wattless components of current, if any, will indirectly vary this I^2R loss according to whether they are neutralized or not.

Effect of Reactive Loads Upon Line Efficiency.—The effects of reactive loads upon the performance of the generator are well understood and have been set forth in numerous experiments. The effect of such loads upon the transmission is to increase the current for the same energy transmitted over that required when the current in the line is in phase with its impressed EMF., the line loss increasing, as the square of the current will be much increased with increase of phase displacement. From this consideration alone it would appear that the line current should be in phase with its EMF. for the most efficient performance. Considering, however, the voltage and drop for a given amount of power delivered, it is to be noted that conditions may arise in practice in which an inductive line may transmit energy at a higher efficiency than a non-inductive one.

Conditions Assumed.—It is desired to transmit, by three-phase system, with step-up and step-down transformation, from 1 to 8 kw., 40.75 miles, at 2,300 volts and 64 cycles, with a transmission efficiency, between generator terminals and receiver secondary terminals, of not less than 80 per cent., at full and practically non-inductive load on the receiver secondary circuit. The size and frequency were necessarily determined by the polyphase generator available.

No. 4 (B. & S. gauge) copper wire was selected, giving a line loss per phase of 0.215 kw., or about 8 per cent., on a basis of 2.66 kw. output per phase from receiver secondary terminals, under normal voltage and non-inductive load. The line constants chosen are suited to a distance apart of the wires of 18 inches at the vertices of an equilateral triangle.

Self-Inductance and Inductive Reactance.—The artificial inductive reactance provided for each wire of the three-phase line was an air-core coil wound and adjusted to the proper self-inductance of this line wire under the conditions assumed. Maxwell's bridge method* was used in standardizing these three inductances. The accuracy of the standard inductance and resistances used and the sensitiveness of the galvanometer warranted an accuracy to within one-fifth of 1 per cent. Air-core coils were selected to insure that such equivalent inductance of the artificial line (and therefore its reactance at constant frequency) would remain constant throughout all variations of line current. These reactance coils, Fig. 1, were each immersed in earthenware jars filled with a high grade of transformer oil and always used in this condition. While in use they attained a temperature of approximately 70° C., and remained practically at this temperature during the experiment. The resistance of each coil at this temperature was 9.0 ohms.

Ohmic Resistance.—The total ohmic resistance of each line wire for the given conditions should be 53.4 ohms. To supply the remaining 44.4 ohms for each line wire, three non-inductive resistances were constructed by winding No. 17 (B. & S. gauge) german-silver wire non-inductively upon frames, as shown above the switchboard, Fig. 2. These resistances were each adjusted by an accurate Wheatstone bridge to the value of 44.4 ohms, at about 85° F., the temperature of the room.

Capacity and Capacity Reactance.—The artificial capacity of the three-phase line was composed of six commercial electrostatic condensers, two condensers each being connected in series and thence connected in star between the three line wires. These condensers were arranged so that the capacity between each of the line wires and the neutral was 0.701 microfarads. The outer terminals of the star-connected condensers were respectively connected to the middle points of the non-inductive resistances of each line wire, Fig. 3. Such an arrangement was equivalent to concentrating all of the capacity of the 40.75-mile transmission line midway between the generator and receiver ends.

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*Paper read at the 18th Annual Convention of the American Institute of Electrical Engineers, Buffalo, N. Y., August 21, 1901.

*Maxwell's "Electricity and Magnetism," Vol. II, p. 367.

TABLE I.

DATA OF ARTIFICIAL TRANSMISSION LINE.

Length of transmission	40.75 miles
Diameter of conductors, No. 4 B. & S.	0.204 inches
Area of conductors	41,742 cir. mils
Resistance per mile at 75° F.	1.31 ohms
Frequency, cycles per second	64

CONSTANTS OF THE LINE COMPUTED FROM THE ABOVE DATA.

Inductance per mile of wire or one-half mile of transmission	0.001750 henrys
Inductive reactance per mile of wire, 64 p. p. s.	0.708 ohms
Impedance per mile of wire, 64 p. p. s.	1.487 ohms
Impedance factor of line, impedance divided by resistance	1.134
Resistance of 40.75-mile transmission line (or 81.50 miles of line wire)	106.8 ohms
Inductance of 40.75-mile transmission line (or 81.50 miles of line wire)	0.1426 henrys
Inductive reactance of 40.75-mile transmission line, 64 p. p. s.	57.3 ohms
Impedance of 40.75-mile transmission line, 64 p.p.s.	121.2 ohms
Capacity of each wire to neutral per mile of transmission line	0.01752 m.f.
Capacity reactance between two wires per mile of transmission at 64 p. p. s.	1,499,800 ohms
Capacity of 40.75-mile transmission line considered as two parallel cylinders	0.701 m. f.
Capacity reactance between two wires of 40.75-mile transmission line	355,300 ohms
Charging current per phase of 40.75-mile transmission, 64 p. p. s. and 2,300 volts	0.374 amperes
Total apparent energy to charge line, 64 p. p. s. and 2,300 volts	1.49 kw.
Total true energy to charge line, 64 p. p. s. and 2,300 volts, or total I^2R due to charging current	0.011 kw
Current per phase to transmit 8 kw. at 2,300 volts and unity power factor	2.01 amperes

TABLE II.

DATA OF THE ARTIFICIAL SUBSTITUTES FOR LINE CONSTANTS.

Size of wire of reactance coil for each line wire	No. 18 B. & S. gauge
Inside diameter of each reactance coil	1.87 inches
Outside diameter of each reactance coil	4.0 inches
Length of each reactance coil	14.25 inches
Approximate number of turns on each reactance coil	1,420
Inductance of each reactance coil	0.0713 henrys
Ohmic resistance of each reactance coil, 70° C.	9.0 ohms
Resistance of non-inductive portion of each line wire	44.4 ohms
Total ohmic resistance of each artificial line	53.4 ohms
Equivalent artificial capacity per phase of each line wire to neutral	0.701 m. f.

Connections Used in Operation.—The reactance coils were placed at the receiver end, all of the line reactance being assumed as concentrated at that point. In series with each of these reactance coils was placed one of the non-inductive resistances, with its respective condensers.

The connections of apparatus and instruments for the various experiments are shown in Fig. 3. In the experiments for charging current and resonant rise the switches R, S and T were open.

Description of the Generator.—Three-phase current was generated from a machine made by the Westinghouse Electric and Manufacturing Company, constructed for single and polyphase work, as generator, synchronous motor or converter. The armature has a distributed winding, and was here tapped off as a three-phase delta combination.

DIMENSIONS AND MEASUREMENTS OF GENERATOR.

Type	Polyphase converter
Serial number	135,751
Capacity	10 kilowatts
Number of poles	4
Revolutions per minute	1,920
Frequency	64 cycles
Normal volts, three phase	410
Full-load current per branch, 3 phase	14 amperes
Resistance of field, hot	685 ohms
Resistance of armature per phase, hot	0.92 ohm

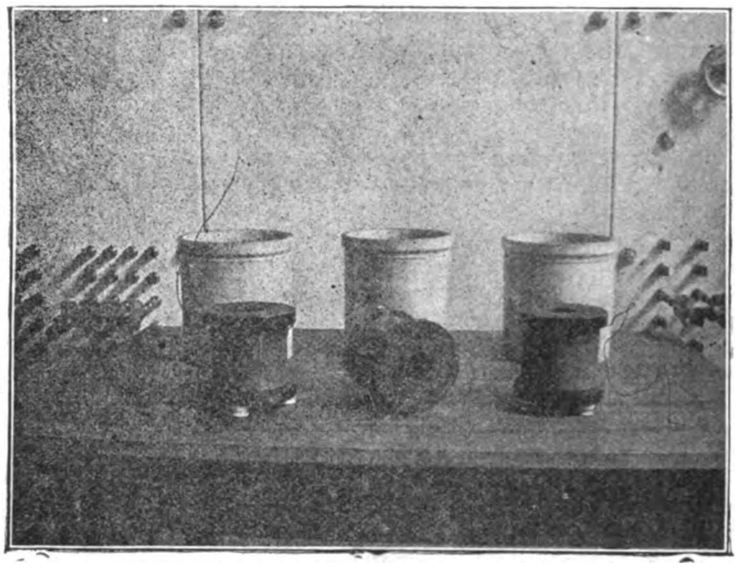

FIG. 1.—COILS FOR ARTIFICIAL REACTANCES.

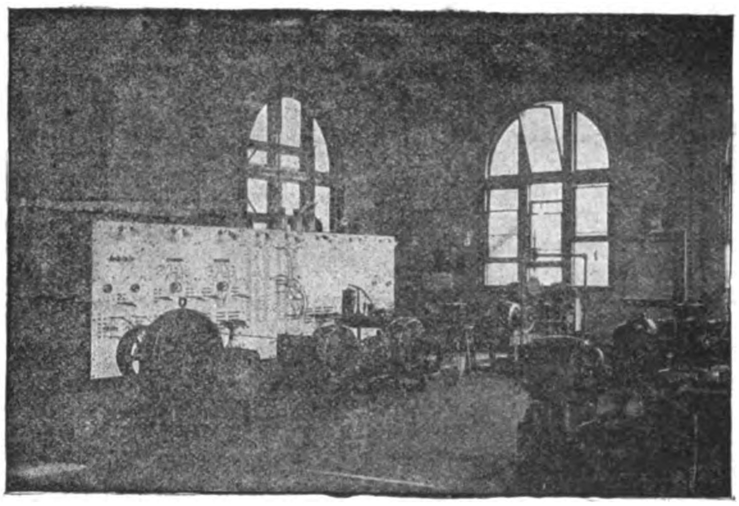

FIG. 2.—ARRANGEMENT OF ARTIFICIAL LINE ABOVE SWITCHBOARD.

External Characteristics of Generator.—External characteristics were taken of this machine under various reactive loads with lagging and leading phase displacement[*]. The results are shown in Fig. 4. In obtaining each of these curves the true power was measured by the two-wattmeter method. The power factor of the external circuit was kept constant throughout the whole range of load by maintaining constant the ratio of the two-wattmeter readings[†].

Charging Current of the Artificial Line.—The receiver end was open-circuited and the charging current measured as on a three-phase line. One of the line wires at the generator end was disconnected and the charging current measured with the same voltage and frequency applied to the line as before. In the case of the three-phase line the total charging current was $2/\sqrt{3}$ that of the charging current of the single phase line.

Resonant Rise.—An experiment was made to determine the rise of voltage at the receiver end primarily due to resonance. The line at the receiver end was opened and a Weston voltmeter, with suitable multiplier, was then placed across the terminal of one of the phases. Fig. 5 shows the results of this experiment, giving the relation between charging current and resonant rise for various voltages at generator end. During the interval when the charging current was measured, the voltmeter was not in circuit, and hence there was no current taken off the line at the receiver end.

Let e = percentage rise of potential due to resonance.[*]

C = total capacity of line, in farads.

L = in inductance in henrys, of total length of one circuit.

$\omega = 2\pi n$, where n is the frequency or p. p. s.

$$\text{Then, } e = \frac{C\,\omega\,L\,\omega 100}{2}$$

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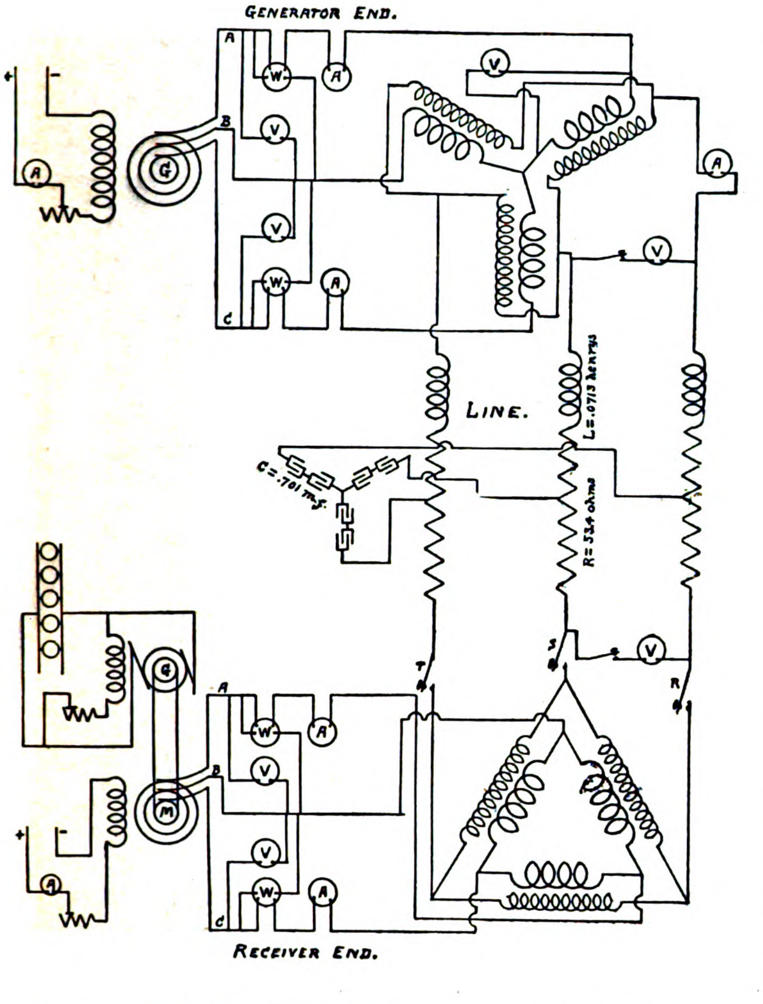
[*] "The Regulation of Alternators Under Variable Reactive Loads." George W. Redfield, "Technograph," University of Illinois. No. 15, p. 95, 1901.

[†] "Power Factor Measurements," B. Frankenfield. "Electrical World and Engineer," Vol. 35, p. 178. Feb. 3, 1900.

[*] "The Use of Aluminum Line Wire and Some Constants for Transmission Lines," by F. A. C. Perrine and F. G. Baum, "Transactions," Vol. XVII, p. 845.

The quantities C and L are proportional to the length of line and therefore the percentage rise in potential varies practically as the square of the length of the line and the square of the frequency.



CONNECTIONS FOR TESTS OF 40-MILE ARTIFICIAL TRANSMISSION LINE.

Fig. 3.

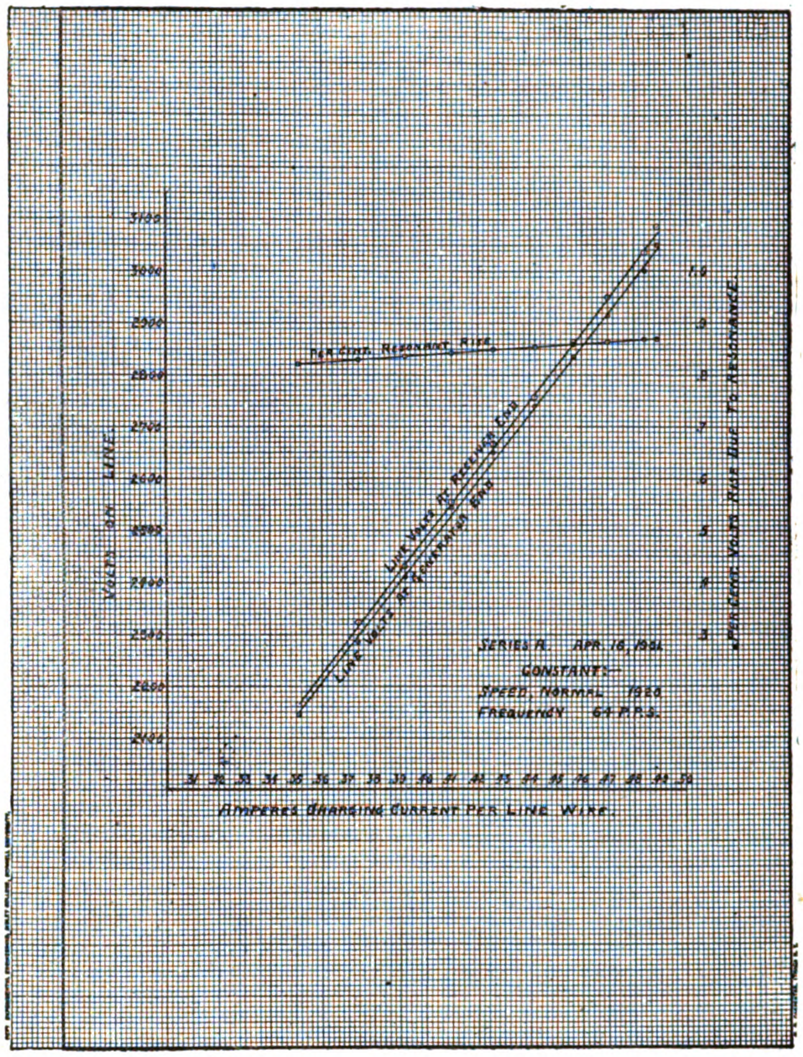


Fig. 5.

Relation between Charging Current and Resonant Rise for Various Voltages at Generator End.

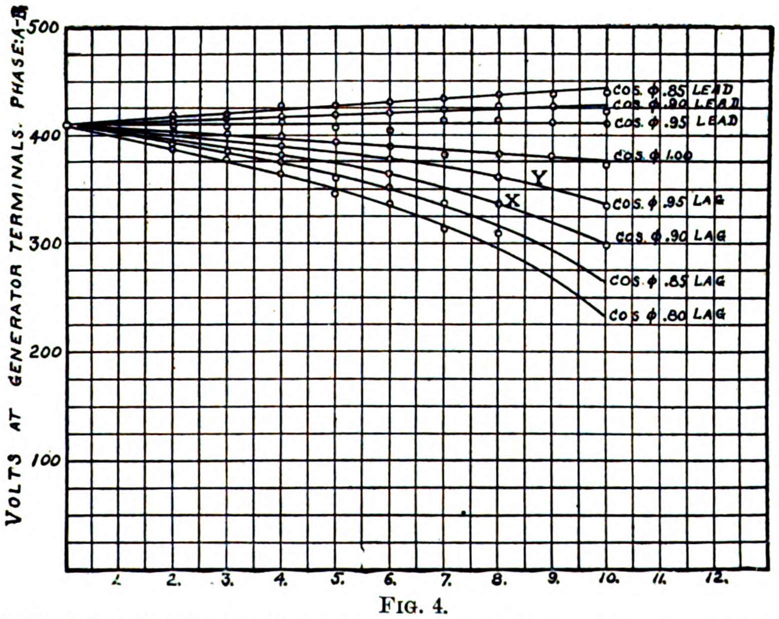


Fig. 4.

External characteristics of Westinghouse 10 kw. Alternator as three-phase Generator, showing the effect of Variable Reactive Loads on Regulation.

Substituting in this formula the values for the 40.75-mile line, we have,

$$\frac{10^{-6}\times 0.701\times 401.5\times(0.0713\times 2)\times 401.5\times 100}{2}$$

$= 0.816,$

this being the calculated per cent. rise due to resonance for this line. By a glance at Fig. 5, it will be noticed that the observed values for the per cent. resonant rise agree very closely with the above computed value. It also shows that this per cent. resonant rise is practically independent of the voltage applied to the line.

All power factor values of the three-phase circuit were determined from two-wattmeter measurements by use of the well-known curve of ratios of wattmeter readings in connection with the cosine curves for balanced three-phase system.*

(To be continued.)

ELEMENTS OF DESIGN PARTICULARLY PERTAINING TO LONG DISTANCE TRANSMISSION.†

BY F. A. C. PERRINE.

The popular admiration of a big thing is not unwarranted from an engineering standpoint. The mere bigness of an engineering problem oftentimes introduces new elements into the solution. Ordinary methods of handling materials become impracticable when the size of the work passes that usually undertaken, stresses heretofore unconsidered become important and introduce great difficulties by reason of the extra precautions necessary in their consideration. The electrical transmission problem is no exception to this general rule, for, were it always necessary to consider all the phenomena involved in every electrical transmission problem, the solution of a great long distance problem would be the same as that for the smallest piece of work, since the introduction of larger figures into an equation introduces no difficulties in the solution. But this is not the case. In short distance work there are less terms in the equation than there are in long distance work, and in handling extremely high potentials we must consider not only the electrical factors of safety, but also the mechanical factors of safety, for the reason that good insulations are never materials of great strength, and can be relied on for their mechanical properties only when the mechanical strains are unimportant in comparison with the size of the insulating pieces employed. Were it not for these considerations it might be more expensive to transmit 10,000 kw. one hundred miles than to transmit the same amount of power a single mile, but to the competent electrician not more difficult. All of the phenomena which must be considered in short distance work are introduced into long distance problems in the same form. The difficulty in long distance transmission problems lies in the introduction of phenomena which are not new, but which, as has already been said, are important only in work of the latter class.

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*Ibid. Frankenfield.

†Paper read at the 18th Annual Convention of the American Institute of Electrical Engineers, Buffalo, N. Y., August 22, 1901.

No new interpretation of Ohm's law becomes necessary as resistance rises and our lines become long, and the loss of energy over a wire of a given resistance due to its resistance remains unchanged, though, of course, we must always give due consideration to the false resistance effects that may be introduced by the size of the conductors employed. In the earlier transmission lines where distances of from 10 to 20 miles were considered, and voltages from five to 20,000 volts employed, investors hesitated to buy the amount of conductor material necessary to reduce the losses, to amounts of the order employed in short distance work, and in consequence with resistance losses amounting to from 20 to 30 per cent. While the regulation problems were of great difficulty, the wires were small, and the false resistance or so-called "skin effects" unnoticed. But with the continued success that has attended the introduction of long distance lines, the investors who have had sufficient courage to approach the problem of transmitting great powers over great distances have felt it unnecessary to restrict the engineers in the quantity of material, and, in consequence, the most recent systems have employed conductors of such a size as to necessitate the consideration of these phenomena a matter of no great difficulty to be sure, and one which only determines the limit of size of a single line. This problem has been further simplified by an agreement between the engineer and the investor that for permanence of supply duplicate lines seem almost necessary.

Perhaps the most important question to face in the long distance transmission is that of regulation. In working short lines, even with alternating currents, the regulation as the load changes is determined almost completely by the resistance effect. Occasionally when heavier currents are employed the self-inductive effects have to be considered, and generally the mutual induction from and to other lines becomes an important factor, though in determining the question of regulation the capacity effects are entirely unimportant.

Whether the lines are long or short, the current small or great, self induction, mutual induction, and capacity, as well as resistance are ever present as phenomena. But while with short lines the capacity is the least important of these phenomena and is so unimportant as to be absolutely unconsidered, with long distance lines it becomes the predominant factor. The importance of the capacity factor increases with the quantity of the charging current. This quantity, of course, depends upon the capacity of the circuit, the voltage employed, and the periodicity. A long distance line would be commercially unsuccessful were not the highest possible voltages used, and the usefulness of the current rises, within certain limits, with the periodicity. Accordingly in long distance lines where periodicities are employed from which incandescent and arc lighting may be directly performed, high voltages entail very great charging currents to such an extent that in a line of 100 miles in length, operating at a voltage of 50 or 60,000 volts and a periodicity of 60, the charging current amounts to something in excess of 2,000 kilovolt amperes, and employs such a proportion of the capacity at the station for charging the idle lines as to make the introduction of units smaller than 2,000 kw. inadvisable, and renders commercially impracticable the transmission of powers less than about 3,000 kw., unless the capacity effect be neutralized by the use of reactive coils.

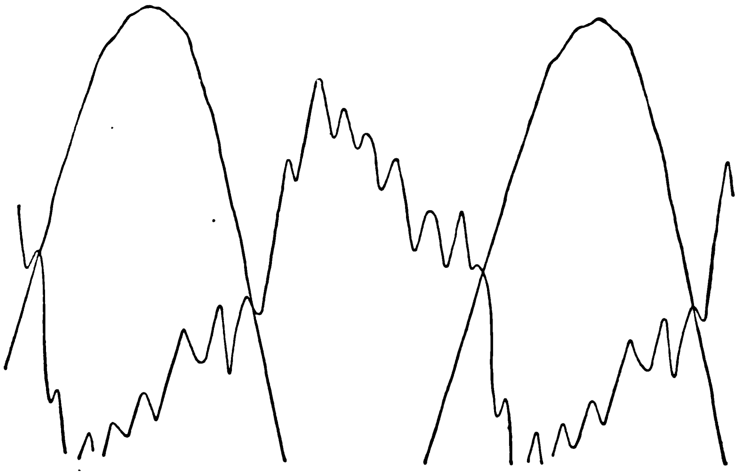

FIG. 1.

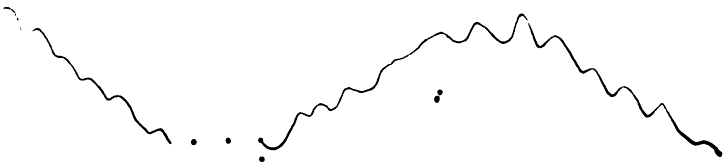

FIG. 2.

Following the capacity in important effect on regulation is the self-induction. While the mutual induction may become another factor, it is only considered in order to be eliminated by transposition of the wires, all of which leaves of the three final factors involved, the resistance of the line in the most unimportant place, though in short distance work it is the determining factor. The elimination of mutual induction by transposition is generally an exceedingly simple problem, for the reason that the lines are almost invariably few in number and follow each other with constant load for considerable distances, allowing the transpositions to be readily made at or between poles where every facility is offered for making them simple. The self-inductive effects, while important, and increased by the length of the lines, are nevertheless comparatively small in reference to the total amount of power transmitted, for the reason that the high voltages decrease the quantity of current, and so far as the line is concerned, the self-induction is rather a benefit than a detriment when the leads are constant, since the leading current due to capacity is relatively so large. Self-induction does indeed impair the regulation as the load changes and the more nearly the line capacity is balanced by outside inductances the more important becomes the effect of the self-induction except where the load is absorbed by synchronous motors, rotary transformers or other apparatus which is capable of operating with a leading power factor, in which case the line capacity may be balanced by some form of load having a constant inductance and the line inductance balanced by a leading load variable with the reactance drop along the line. Indeed were it always possible to install long distance lines with a constant inductive load capable of neutralizing altogether the capacity effect, a variable synchronous motor or other leading load adjusted to neutralize at all times the self-induction of the line, the problem of regulation in a long distance power transmission line would be reduced to the simplicity of the regulation in short direct current transmissions.

With variable loads the capacity and self inductive effects cannot truly be said to neutralize each other, for the reason that the capacity effect is constant, and the self-inductive effect variable with the load, and where a long line is loaded altogether with lagging loads the conditions for regulation are the worst possible. This will be explained later, as we now further discuss the effect of capacity. One of the most noticeable effects of capacity is its action in reference to the wave form of the generators. Should a peaked electromotive force wave form be delivered by the generators to a line containing a heavy capacity, the line would usually have the effect of somewhat neutralizing the generator defects, and will furnish to the translating devices at the delivery end of the line a smoother curve than was originally delivered by the generator, but where the generator curve is a sine curve or as is more common with modern types of generators, a curve with a slightly flattened top, the capacity tends to increase this flattening; at the same time in the current curve all harmonies are accentuated by the presence of capacity in the line and receiving circuit. The extent of this action is illustrated in Figs. 1

and 2, which are reproduced from oscillagraph curves taken by Prof. E. E. Farmer, of the Stanford University, from the lines of the Independent Electric Light Company of San Francisco. This company is not operating a long distance transmission system, but its circuits being all underground are of a high capacity, and in consequence the necessary points are illustrated by these curves. In Fig. 1 the smooth curve is the electromotive force curve at the generating end of the line. The rough curve being the corresponding current curve, the lines being unloaded except by reason of the capacity current. Fig. 2 is the same current curve as it is found at the point distant from the power house along the cables.

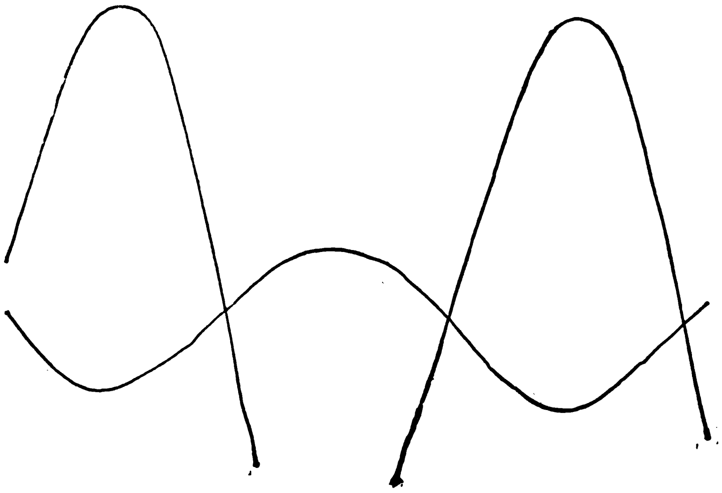

FIG. 3.

The peaked character of the current curves in this case seems to be due to harmonies from the armature slots in the generator, since they correspond in number and position to these slots. That this is not due to any errors in the oscillagraph itself is shown in Fig. 3, which gives the electromotive force curve taken with both the current and electromotive force windings of the oscillagraph in series, and shows that the two windings give corresponding results when operated by the same wave form but displaced in phase 90°. Fig. 2 shows at once by examination that the effect of the circuit has been to reduce the accentuation of the teeth of the current curve so illustrating the points made. The disadvantages that may arise from this condition were illustrated in the writer's practice in a line 45 miles in length, operated at 60 cycles and 25,000 volts. A synchronous motor was employed having a naturally bad wave form. The maximum point of the wave rising far above the point represented by the equivalent sine wave. In this case at no load the motor took full load current and at full load a current much in excess of the normal. The difficulty was remedied by paralleling the lines at the delivery end with a reactance coil. These experiments have been described in detail by the writer in a paper presented May 17, 1900, before this society. These results have been borne out more recently by observations made on a 140 mile line supplying synchronous motors of a better design, one synchronous motor being of the revolving field type, and another of the inductor type. Both of these motors give a fairly correct wave form, and in neither of them the difficulty of the earlier experiments has been repeated, fortunately proving that the difficulty from modifications of the wave form in lines due to the capacity, can be overcome by the choice of correct motors. By far the most important effect of the capacity relates to the regulation of the transformers and generators attached to the line. A leading current taken from such apparatus having the effect of increasing the voltage, while a lagging current decreases it proportionately. This has nothing to do with the drop in voltage from the line itself, whether on account of resistance or self-induction, or to the rise along the line due to the capacity, but refers only to the action of the generating apparatus, and it can readily be seen that where a line is operated sometimes with no load and sometimes at full load, the change of the power factor from leading to lagging will change the voltage beyond the calculated drop along the lines, and generally beyond the amounts allowed for in any regulating apparatus. Considering this point we see at once that the regulation difficulty that was above spoken of is due to the variability of the self-inductive effect in the line itself, and points to the conclusions that were above drawn of the perfect line being one in which the capacity of the line is neutralized by a constant self-induction and the self-inductive effect of the line is neutralized by a leading load variable with the variations of the load on the line. With lines of high capacity there is a rise in potential along the circuit, but though this effect has produced much discussion, its practical effect in importance is not very great, for the reason that it is entirely overshadowed by its corresponding effect on the apparatus which has just been described. In the case of the longest lines at present operated, this effect does not amount to more than 20 per cent. of the rise in the step-up transformers produced by the same leading current.

As it has already been said, the highest possible potentials are necessary in order to restrict the investment in very long transmission lines. When the voltages rise above 30,000 volts, phenomena become important in the problem of insulation which below that voltage were unnecessary to consider. In the first place voltages from 25,000 to 30,000 volts can be readily handled with insulators of either glass or porcelain having a diameter not exceeding 7 inches. Pieces of glass or porcelain of these dimensions are mechanically strong and are readily manufactured. Where the voltage rises to 50,000 or 60,000 volts, and the sparking distance between the lines increases to between five and six inches, the insulators must have a diameter of at least 12 or 13 inches and be held not less than 7 or 8 inches above the crossarm. Such pieces of these fragile insulating materials are difficult to manufacture, and though the problem has been successfuly solved, the greatest care in design and manufacture is absolutely essential, though it is believed that the factor of safety of high potential insulators as at present designed is by no means as great as that commonly employed with the lower voltages. An even more striking difficulty in handling high voltages lies in the effect of the electrical surface tension or density which, with high voltages and small wires results in a brush discharge and high energy loss independent of leakage over the surface of the insulators, being simply an escape to surrounding bodies from the whole surface of the wire. This we believe was first taken into account by the engineers associated with the writer in carrying out high voltage work. Stated simply, it is found that the electrical tension along the line operating at 50,000 or 60,000 volts renders the use of wires smaller than about ⅜ inch diameter, a dangerous expedient, resulting in important losses, which again points to the fact that high potential long distance transmissions cannot be successfully carried out unless the power to be transmitted is in itself large, warranting the use of conductors of great size.

The important phenomena which rise to view in carrying out the long distance problem have now been presented, and it remains only to call attention to the fact that in this long distance transmission work extraordinary precautions must be taken to maintain the permanence of supply. Long distance transmission means, as we have said, large powers; and large powers delivered at distant points presuppose important engineering undertakings at the delivery end of the line which call for absolute continuity of supply. The poles must be selected and erected with more than ordinary care. The lines must be constantly patrolled. Trees cannot be simply trimmed, but a right of way almost as wide as a railroad right of way secured, and all obstructions of the nature of trees which may fall across the line in high winds removed. The use of the ordinary insulating materials in power houses and supply stations, such as paraffined wood and paraffined marble, must be entirely abandoned or relied upon only as minor auxiliaries, and finally, wherever it is possible, either steam or storage battery auxiliaries at the delivery end of the line furnished. It seems almost unnecessary to call attention to the design of the apparatus in the generating station, but it is perhaps well to mention the fact that the generator and transformer designers may aid the installing engineer very materially by paying particular attention to regulation at the lower power factors even at the cost of some efficiency, should that be necessary. The designer should always remember that regulation in long distance transmission is regulation at other than unity power factor.

The engineering problem, therefore, by its very bigness is one requiring the most careful solution at its every step, and the fact that it is now being successfully carried out merits the highest praise both toward the engineers in designing, and the investors whose faith in their engineers permits the employment of the necessary capital to do the work thoroughly.

The points made in this paper have all at one time or another been particularly discussed before the Institute, and the writer only ventures to bring them together in this sketch in the hope that new points of view may be attained by their discussion in relation to the whole problem.

The Ohio Electric Light Association Convention.

The seventh annual convention of the Ohio Electric Light Association, held recently at Put-in-Bay, was attended by over one hundred members and several new members were admitted. President Ernst J. Bechtel of Toledo presided. W. D. O'Ryan of Lynn, Mass., read an interesting paper on "Relative Merits of Open and Inclosed Arc Lights for Street Illumination." Mr. E. Heitman of Pittsfield, Mass., was not present to read his paper on "The Inductor Type." Mr. Lehman B. Hoitsof of Cleveland presented an illustrated paper on "Construction and Application of Direct Current Apparatus." "Single Phase Alternating Current Motors" was the subject of a paper read by E. S. Pilsbury of St. Louis.

The following officers were elected for the ensuing year: President, W. F. White, Cincinnati; vice-president, E. H. McKnight, Middletown; secretary-treasurer, J. H. Perkins, Youngstown.

The next annual meeting of the association will be held in Columbus in October, 1902.

Proposals Invited.

Sealed proposals will be received at the U. S. Engineers' Office, Washington, D. C., until noon, September 23, for furnishing electrically driven pumps for the new building for Government Printing Office. Information furnished on application to John S. Sewell, 735 North Capitol street, Washington, D. C.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended August 28:

Aberdeen, 1 package, $60; Antwerp, 68 packages, $3,659; Argentine Republic, 24 packages, $2,407; Australia, 516 packages, $132,296; Barcelona, 64 packages, $2,619; Bilbao, 1 case, $50; Brazil, 64 packages, $1,306; Bremen, 4 generators, $1,080; British West Indies, 68 packages, $1,603; British Possessions in Africa, 93 packages, $18,310; British East Indies, 3 packages, $250; 17 cases, $300; Brussels, 1 package, $45; Central America, 11 packages, $170; Cuba, 8 packages, $91; Dutch Guiana, 1 case, $13; Glasgow, 30 packages, $1,727; Hamburg, 58 cases, $2,834; 30 packages trolley poles, $1,000; Havre, 31 packages, $1,862; Leicester, 1 case, $131; Liverpool, 67 packages, $6,786; London, 333 packages, $14,101: Mexico, 17 cases, $825; New Zealand, 38 cases, $1,070; Newcastle, 54 packages, $10,155; Peru, 10 packages, $129; Rotterdam, 2 cases, $50; Santo Domingo, 19 cases, $533; Sheffield, 1 case, $35; Southampton, 44 cases, $6,326; Uruguay, 16 packages, $435; Venezuela, 1 case, $14.

Protect Your Treasures.

The recent robbing of the vault of the Selby Smelting Company at Crockett, Cal., points out the fact that it is necessary to have every protection possible to prevent the removal of valuable material by thieves.

Burglar alarms and other electrical devices, together with the improved locks of to-day, have lessened the attempts to enter a vault by the ordinary method of entrance and the burglars have been obliged to pursue a different course.

It is very evident that to enter a vault in any way except by the door must take a large amount of patient work, all of which must be done in the still hours of the night and must be accompanied with more or less sound.

While this sound may not be discernible to the human ear it cannot escape the microphone, which is capable of transmitting the sound of a fly walking on a board.

Had the Selby Company's vault been equipped with this microphone attachment the drilling of the floor could have easily been detected by the watchman who should listen at the receiver at certain intervals through the night, the act being recorded on a dial. Any slight sound made on any part of the metal would be faithfully recorded and even intensified by the induction coil.

The Ericsson Transmitter is admirably adapted for the purpose on account of its extreme sensitiveness and immunity from packing. Many transmitters will work when used frequently, as this serves to agitate the carbon granules, but very few will work after having stood a long time in absolute stillness without first being shaken slightly.

This fact leaves the Ericsson in a field by itself for this class of work, and combined with the receiver and other apparatus of equal merit makes an equipment that can be thoroughly relied on in every instance.

Further information concerning this apparatus or anything else in the telephone line can be obtained by writing to the office of the Ericsson Telephone Company, 296 Broadway, New York City.

COMING ELECTRICAL EVENTS

American Street Railway Association—Convention, New York City, October 9, 10 and 11.

American Electro-Therapeutic Association—Buffalo, N. Y., September 24, 25 and 26.

Association of the Edison Illuminating Companies—Meeting, September 10.

Old-Time Telegraphers' Association and U. S. Military Telegraph Corps—Convention, Montreal, September 11, 12 and 13.

Pennsylvania State Street Railway Association—Convention, York, Pa., September 4.

Roentgen Society of the United States—Meeting, Buffalo, N. Y., September 10 and 11.

INCORPORATIONS.

The Trevorton Electric Light & Power Company, Trevorton, Pa. Capital stock, $5,000.

The Southern Electrical Supply Company, Norfolk, Va. Capital stock, $100,000. H. R. Gay, of Baltimore, is vice, president.

The Callum Electrical Company, Wilmington, Del.—to operate signal lights on any bay shore or bay in the United States. Capital stock, $500,000.

The Corn Palace Electric Construction Company, Sioux City, Ia. Capital stock, $10,000. Incorporators: Charles A. Hickman and Simeon A. Hickman.

The American Maintenance Company, Chicago—to build and maintain electrical or mechanical plants. Capital stock, $2,500. Incorporators: O. E. Becker, N. J. Johnson and O. B. Swanson.

The Hydra Manufacturers' Agency, New York City—to purchase and place in operation electric batteries, particularly those known as the Hydra Double Batteries. Capital stock, $50,000.

The Western New York Water Power Company, Buffalo, N. Y.—to manufacture electricity. Capital stock, $50,000. Directors: Edward S. A. McLeod, W. E. Frampton and F. B. Hartzell, all of Buffalo.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUGUST 27, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

681,293. Electric System for Railways. Daniel S. Bergin, Chicago, Ill. Filed May 23, 1901.

681,350. Street-Car Fender. Charles T. Stoelting, St. Louis, Mo. Filed May 6, 1901.

681,361. Car-Fender. John B. Wood, Cranston, R. I. Filed Jan. 31, 1901.

681,410. Electric-Traction Road. Leon Dion, Boston, Mass. Filed Jan. 28, 1901.

681,458. Controller for Electric-Railway Motors. Frank A. Merrick and Emmett W. Stull, Johnstown, Pa., assignors to the Lorain Steel Company of Pennsylvania, Filed Sept. 28, 1900.

681,474. Electromagnetic Safety System for Railroads. Charles M. Cronkite, Lansing, Mich., assignor of one-tenth to James E. Hilliard, same place. Filed Aug. 27, 1900.

681,604. Feeder-Cable Holder for Electric-Railway Systems. Walter D. Young, Baltimore, Md. Filed Feb. 1, 1901.

681,605. Crossover-Switch for Electric-Railway Systems. Walter D. Young, Baltimore, Md. Filed Feb. 12, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

681,179. Electric-Arc Lamp. Francis B. Badt, Chicago, Ill. Filed Feb. 25, 1901.

681,352. Heater for Electrolytic Incandescent Lamps. James Swinburne, Westminster, Eng., assignor to the Electric Resistance & Heating Company, Limited, London, Eng. Filed Jan. 8, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

681,211. Electric Detector for Valves. Charles B. Garrett, Minneapolis, Minn., assignor of one half to Martin Dyke, same place. Filed March 20, 1900.

681,269. Motor-Controller. Rumsey W. Scott, New York City. Filed Dec. 19, 1900.

681,295. Dynamo-Electric Machine. John B. Blood, Newburyport, Mass. Filed March 18, 1901.

681,317. Core and Pole-Piece for Field-Magnets of Dynamos or Motors. Robert Hirsch, Milwaukee, Wis., assignor of one half to William B. Voth, same place. Filed Oct. 19, 1899. Renewed June 29, 1901.

681,358. Electric Switch. George B. Thomas, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing Company, same place. Filed March 5, 1901.

681,416. Outlet for Electric Conductors. John H. Goehst and Charles M Wilkes, Chicago, Ill. Filed Dec. 17, 1900.

681,421. Supporting Device for Brush Holders. John P. Mallett, Madison, Wis., assignor to the Northern Electrical Manufacturing Company, same place. Filed May 10, 1901.

681,625. Autopneumatic Regulator for Motors. William B. Cowles, Cleveland, O., assignor to the Long Arm System Company, same place. Filed May 28, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

681,296. Telephone-Receiver-Support Lock. Addington L. Brinckle, Philadelphia, Pa., assignor of one-half to Benjamin C. Fox and William O. McClurg, Chester, Pa. Filed May 15, 1901.

681,374. Microphone and Telephone Installation. Lipa Polinkowsky, Berlin, Germany, assignor to Siemens & Halske Aktiengesellschaft, same place. Filed April 8, 1901.

681,408. Adjustable Arm for Supporting Telephone-Receivers. Edward M. Cox and Walter Reed, Portland, Ore. Filed Nov. 20, 1900.

681,603. Mechanical Intercommunication Between Telephone-Switchboards. George M. Yorke, New York City, assignor to the American Telephone & Telegraph Company of New York. Filed March 20, 1901.

MISCELLANEOUS.

681,185. Telegrapher's Finger Guard. Ira H. Blessing, Albany, N. Y. Filed Nov. 14, 1900.

681,219-681,220. Motor-Vehicle. Bohn C. Hicks, Chicago, Ill., assignor to the Hicks Motor Cycle Company, same place. Filed Oct. 22, 1900.

681,221. Submarine Boat. John P. Holland, Newark, N. J., assignor to the Electric Boat Company of New Jersey. Filed Sept. 27, 1900.

681,222. Submarine Vessel. John P. Holland, Newark, N. J., assignor to the Electric Boat Company of New Jersey. Filed Oct. 3, 1900.

681,329. Method of Making Secondary-Battery Plates. Berthold Kuettner, London, Eng. Filed Oct. 25, 1900.

681,341. Magnetic Device for Restoring and Aiding Hearing. Samuel G. Payn, Jr., Bath on Hudson, N. Y. Filed Jan. 17, 1901.

681,371. Signaling Apparatus. Gwynne E. Painter, Baltimore, Md. Filed Jan. 26, 1901.

681,461. Attaching-Plug for Electric Wires. Luttrell H. Stuart, Chicago, Ill. Filed May 1, 1901.

681,470. Removable Jacket for Electric Cables. James Wolff, Chicago, Ill. Filed Aug. 24, 1900.

681,495. Electric Switch for Alarms. Israel B. Chantler, Sewickley, Pa. Filed March 8, 1901.

681,532. Diaphragm for Electric Batteries. John L. Dobell, Harlesden, Eng. Filed Dec. 6, 1897.

681,576. Motor-Carriage. Albert S. Parsons, Berkeley, Cal. Filed July 7, 1899. Renewed April 25, 1901.

681,617. Telegraphic Apparatus. Sidney G. Brown, Bournemouth, Eng. Filed March 29, 1900.

681,640. Electric Marine Governor. Thomas P. Housden, San Antonio, Tex. Filed Dec. 5, 1900.

681,654. Electric Prospecting Apparatus. Augustus F. McClatchey, Aurora, Ill., assignor to Frederick M. Steele and Ernest Dale Owen, Chicago, Ill. Filed April 20, 1900.

681,660. Primary Battery. Otto A. Spahr, Millersburg, O. Filed June 9, 1900.

THE TELEPHONE WORLD.

Independent Consolidated Telephone Company Incorporated in Wisconsin.

The Independent Consolidated Telephone Company, with headquarters at Milwaukee, was incorporated last week by A. L. Hutchinson, Edwin I. Fairchild and Harry S. Hadfield with $500,000 capital. A meeting of those interested was held to perfect plans for the completion of this company, which will operate throughout the State.

The company now controls a number of smaller lines in Wisconsin. A main line is to be constructed from Escanaba, Mich., to Milwaukee. and exchanges will be established in all the cities along the route where none are as yet established.

Besides the gentlemen above named, F. H. Lord and W. W. Townsend of Chicago are also interested in the line. E. T. Monger, of Green Bay, an electrical engineer, is a stockholder and will begin operations at once. R. Valentine of Janesville, E. W. Keyser of Waukesha, J. C. Harper and L. W. Burch of Madison, and C. W. Switzer of LaCrosse are other stockholders.

The company has already obtained options on 600 miles of toll lines, and when completed will have 1,000 miles, and the capital invested will be $1,000,000.

All is at peace between the two telephone companies in the Chancery Court of Shelby County, Tenn. The last shadow of difference which existed heretofore has been removed. The two are at peace so far as the courts of the county are concerned. There was a little while back a display of injunction which was most startling. It looked as if an endless war might be inaugurated between the Memphis Telephone & Telegraph Company and the Cumberland Telephone & Telegraph Company. The bill introduced and the subsequent documents filed in the case complicated matters to such an extent that it seemed that the possibilities of an adjustment without additional legal process was impossible. The trouble ended, however, without so much as a hearing. The two companies through their respective legal representatives appeared in court, and asked that the suits be withdrawn. This indicates clearly that the settlement arrived at has been effectual and that the companies will not for awhile at least enter the courts.

A report from New Haven, Conn., states that improvements have been made in the local telephone office that provide facilities for a better service during the busy hours. Another transmitter has been attached to the switchboard, allowing two operators to work at the same time. Head receivers, which have been added also, will make the work easier for the operators, and they can attend to calls more rapidly. The increase in business at the office during the past six months has demanded the improvements. More business is being done there at present than at any time since the opening of the office. The reduction in rates has invited several new subscribers.

News from Miamisburg, O , asserts that the Central Telephone Company has completed two rural lines, and is prepared to give the best of country service from now on. Over forty subscribers have already been secured. The new lines are over the Springboro pike and the Ellerton road. A line is being built over the Centerville pike. E. Cure of Dayton, O., has charge of the work of construction and is pushing it admirably.

The United Telegraph & Telephone Company of Minneapolis, Minn., has filed a trust deed to secure $40,000 worth of bonds to the Minnesota Loan & Trust Company. The bonds are for ten years at 6 per cent. This deed must be filed in every county through which the lines of the company pass.

The Rawson Electric Company, which is constructing the Home Telephone plant in Lockport, N. Y., has commenced connecting up the telephones, and already ten 'phones are in working order. The middle of this month will see the exchange in full working order in that city.

The Central New York Telephone Company's exchange in Canton has assumed a goodly portion and the equipment being of the long-distance type it is giving excellent satisfaction.

According to an account received from St. Paul, Minn., the Twin City Telephone Company will install a model telephone exchange at the State Fair grounds.

All indications point to the establishment of a new central office of the New England Telephone & Telegraph Company in North Brookfield, Mass.

The Dauphin, Pa., County Telephone Company expects to start work on its new line in Steelton shortly.

Combining Telephone Plants.

Using the language of the New York "Mail and Express," an official of the Interstate Telephone Company of New Jersey, capital $5,000,000, says that the company now has in its possession in that State all but two of the Bell Company's rivals. Of these two companies, the Eastern Telephone & Telegraph Company of Camden is practically controlled by David Baird, of Camden, who owns nearly a majority of its $300,000 capital stock. Negotiations between the Interstate and Mr. Baird, with a view to a merger, are now in progress.

In Pennsylvania, the Consolidated Telephone Companies, which have issued $3,250,000 of their $4,000,000 capital stock in exchange for the securities of underlying concerns extending to Wilkes-Barre, Carbondale and Reading, are now considering the feasibility of an extension of their system still further westward, although nothing definite has yet been done in this direction.

New Telephone System for Steamers.

The New York & New Jersey Telephone Company has introduced a novel telephone system on the piers of the Hamburg-American and the North German Lloyd Company. Telephone apparatus is placed on the steamers of the company and a station erected on the piers. Connection is made by a flexible cord By this means telephone communication can be established with incoming steamers before the gang plank is put out. In the case of outgoing steamers passengers can have telephone communication with their friends till the vessel leaves the pier.

It looks very much as though there might, in the future, be a competing telephone system put in in Nashua, N.H. Representatives of a new telephone company have been in that city and have had a conference with a number of business men relative to adopting the service, providing it is put in. An interested party there recently said: "There certainly will be an attempt to establish a new telephone service in this city. From what I know of the matter it will be the same as the Independent Telephone Company operating in the cities and towns of Massachusetts and other parts of the country. The advantage of the new system which this company, I am informed, desires to introduce here, is that it will do away entirely with a telephone exchange. The great feature will be the cheapness for which telephones may be rented."

A telephone war is predicted for Hamilton, O., within the next few days between the Bell Telephone Company and the Everett-Moore syndicate of Cleveland. It is stated that the control of the Hamilton, Hughes & Monroe Telephone Company and the Western Butler County Telephone Company has passed into the hands of the Everett-Moore syndicate, and that it will erect 160 new 45-foot poles in Hamilton. The Hamilton & Hughes Company has a city franchise granted by the old council five years ago, and it is under this grant the extensions are to be made.

New telephones are to be installed in the business district in Kansas City, Mo., south of 11th street, within the next month. This change will follow the completion of the new exchange at 17th and Main streets. The chief feature of the improvement is that there will be no necessity of ringing the bell. In fact there is no crank to turn. One will just lift the receiver and this will flash a light before the telephone operator's eye, and the connection will be made almost instantaneously.

The municipal telephone system was inaugurated August 29 at Glasgow, Scotland, with all the latest improvements, wires all underground and 16,500 miles of wire. Provision is made for 20,000 subscribers; the service is designed to be as perfect as possible, affording the public every facility for cheap and convenient communication. Officials inspected the system and found it ready for business.

A project is under way to construct a telephone line from Pierre, S. D., to the Black Hills. The company is to be incorporated in a few days and work will be begun at once. The line will connect with Black Hills systems and give that section direct communication with the eastern part of the State.

The Tennessee River Telephone Company of Meigs County has amended its charter. The capital stock is increased from $3,000 to $10,000.

A local telephone company was lately organized at Franklin, Tenn.

Mountain View, Okla., is to have a telephone exchange.

War Against the Bell Company.

The Independent Telephone Company of Windsor, Mo, has applied for a franchise in Warrensburg. The Twentieth Century Telephone Company of Pleasant Hill has been at the latter place for several weeks endeavoring to secure a franchise. The companies will endeavor to oust the Bell Company's local system if admitted.

J. D. Hobbs and J. D. Peachey are installing a novel telephone system in East Orange, N. J. Their idea is to make a one-sided telephone service take the place of messenger call boxes as well as police and fire alarm calls. They have a small central station. The name of the new instrument is orderphone, and it is used only for outgoing calls. Fifty cents a month is paid by the subscriber for the privilege of calling central to order from the butcher, grocer, coal dealer or other tradesman, and at the same time the instrument can be used as a police or fire call in the daytime and as an automatic burglar alarm and thermostatic fire alarm at night. In construction the telephone is simple. The receiver is removed from the hook, which rises slowly, retarded by a pneumatic valve, and rings its own number in central office by means of contact points, which the hook engages. The call is mechanically recorded at central office and answered by an operator, who at once transmits the order either by telephone or messenger.

E. Bingham Allen has recently been called to Cleveland, O., to take a position with the Consolidated Telephone Company. He was brought from Toledo, where he was connected with the Toledo & Western Electric Railway Company. He is now the general right-of way agent of the Inter-Ocean Telephone Company, which is the long distance department of the Consolidated Company. The Consolidated was formed some time ago in Cleveland. It is capitalized at $10,000,000, is controlled altogether by Cleveland money, and operates independent telephone lines in New York State.

The hands employed by the Southern Bell Telephone Company in putting up poles along the streets of Cartersville, Ga., for the use of the company's exchange that is being established there, were forced to stop work by order of Judge Fite. A bill of injunction was filed by the Cartersville Telephone Company on the plea that its business would be ruined if the new exchange is established. Judge Fite granted a temporary restraining order and set the case for a hearing on September 20.

The Bell Telephone Company has taken down its line between Houston and Money Creek, Minn. It has not been abandoned permanently, and as soon as it is possible will be rebuilt under a new system, and poles placed upon the right of way of the Bell Company.

The Two Rivers, Wis., Telephone Company has let a contract for the installation of the entire new system to take the place of the one now in use, which is no longer adequate to meet the demands. The new system will be so constructed that a patron can have use of the long-distance telephone system.

A company is being organized at Parkston, S. D., to put in a local telephone exchange, and from present indications they will no doubt meet with success.

The Washington County Commissioners have entered suit against the Maryland Telephone Company of Baltimore City to compel payment of $626.16 for taxes for two years on capital stock.

The Pineville, Ky., Telephone Company has leased its whole system to Nodey Starkey, of London, Ky., who will manage it in the future.

The New England Telephone Company has sent a force of men to Portland, Me., for the purpose of installing the new common battery system in all the 'phones around town.

A branch line to Pony, Mont., and the mining district surrounding that town has been completed by the Rocky Mountain Bell Telephone Company.

Greene County, Mo., is said to have the only Farmers' Mutual Telephone Association, systematically and equitably organized and operated, in the State.

Marshfield, Wis., will soon have long-distance telephone connections. The differences between the local company and the Wisconsin Telephone Company have been adjusted, the latter company conceding to all the points.

The Cumberland Telephone Company has put up a telephone line from Knoxville to French, Tenn.

GENERAL ELECTRICAL NEWS.

Lighting.

Abbeville, La.—Albert G. Nouch, of New Iberia, has been granted a franchise for the erection of an electric light plant here.

Chatham, N. J.—At a recent meeting of the borough council, electric light bonds to the amount of $15,000 at 4 per cent. were issued to the Prudential Insurance Company of America. The bonds are payable in twenty years.

Collingwood, Ont.—Fifteen thousand dollars for the improvement and extension of water and light systems of this town was voted on and carried a short time ago.

Harrisonburg, Va.--The town council has fixed upon Tuesday, September 17, as the date for holding a special election on the question of an appropriation for constructing a municipal electric light plant at an estimated cost of $30,000. The plan contemplates a water-power plant on the Shenandoah River, near Shendun, the current to be transmitted by overhead wire a distance of 14 miles. The town is now lighted by a private corporation.

Herkimer, N.Y.—The electric lighting system is constantly increasing here. Nearly 1,200 new lamps have been placed about the village since January 1, and it will be neccessary at no distant date to secure larger generators and engines for the power station.

Ilwaco, Wash.—The citizens of this place are now considering proposals for the installation of water and electric light systems.

Independence, Kan.—L. P. Caldwell of this city has been elected superintendent of the new municipal electric light plant.

Kansas City, Mo.—This city will hold an election in October to vote on the issuance of $300,000 of bonds for the erection of an electric light plant. Address the mayor.

Lumberton, Miss.—R. J. Fenn wants prices on an electric plant of 600 incandescent and 20 arc lights.

Mount Forest, Ont.—A vote of the rate payers was taken here on the by-law to authorize the purchase by the town of the works and property of the Mount Forest Electric Light Company, carried on by Messrs. Corley & Collins. The total vote polled was 212 for and 28 against, making a majority in favor of the by-law of 184.

Ossining, N. Y.—The board of officers has granted a franchise to W. W. Law, of the Brier Cliff Stock Farm, for his electric light and power plant, which he will use to light the new hotel now in course of construction there, and also the Holbrook School and Pleasantville village. Mr. Law also contemplates running a trolley road from his farm to Pleasantville and this place.

Plainfield, Ill.—This town is considering the establishment of an electric light plant.

Plainfield, Vt.—This village is to have electric lights. 175 having already been subscribed for.

Schoolcraft, Mich.—Several times attempts have been made to vote bonds in this village to provide an electric light plant, but they have been defeated each time. Now the village of Vicksburg is considering enlarging its plant and has submitted a proposition to Schoolcraft to run wires from Vicksburg to this village and light both places from the one plant.

Scottsburg, Ky.—Electric lights and waterworks are to be established at this place in the near future.

Solon, Me.—An electric plant is to be established here.

Susquehanna, Pa.—The incandescent dynamos in the works of the Susquehanna Electric Light Company in Oakland were recently damaged by lightning. The estimated damage is from $1,500 to $2,000.

Wellington, Kan.—A number of local capitalists have made up their minds to invest some of their wheat money in an electric light plant. They are formulating a proposition to present to the city council asking for a charter with the provision that the city may at any time purchase the plant from the company and own it.

Yellville, Ark.—The Yellville Electric Light & Power Company, previously reported incorporated, will construct a system of waterworks and electric lights. W. F. Cleveland, president.

Street Railways.

Albany, N. Y.—Last week the Northport Traction Company filed with the Secretary of State a certificate of incorporation. It is organized with a capital of $50,000 to operate an electric road between the East Northport station on the Long Island Railroad and Northport Harbor. The directors are William H. Baldwin, Jr., William F. Brown and William J. Kelly of Brooklyn; F. F. Haff, of Long Island City; John W. Hillman, Edward Pidgeon, Edward Thompson, of Northport; F. C. Scudder, of Babylon, and W. F. Potter, of Flushing.

Carlisle, Pa.—The city council has granted a trolley franchise to the White Hill & Mechanicsburg Company and the Baltimore, Westminster & Gettysburg Company.

Cleveland, O.—T. I. Childs is seeking a franchise for an electric line along the canal from this city to Akron.

Columbus, O.—The county commissioners have granted the Columbus, Delaware & Marion Electric Railroad a franchise for 25 years from Worthington. The beginning of the company's right-of way is near Flint.

Detroit, Mich.—It is said here that following the purchase and consolidation of the electric lines in Detroit and vicinity, the Everett-Moore syndicate of Cleveland, O., has turned to the problem of securing electric power as cheaply as possible, and has decided to establish a plant in the River Rouge district, several miles below this city, on the river front, for the manufacture of coke, and a large number of by-products.

Greenport, N. Y.—It is among the probabilities that a new trolley line running from here to Canarsie will replace the present road running from East New York to the latter place. It is expected that the new road will be in operation next summer. The Long Island Railroad is said to be behind the scheme.

Leechburg, Pa.—The directors of the Apollo Vandergrift & Leechburg Electric Railway have decided to begin work immediately on construction of the road. Dr. J. D. Orr, of this city, is president of the company.

Milwaukee, Wis.—The Milwaukee, Burlington & Lake Geneva Railroad now holds the most valuable franchise ever given to a railroad company in this city. It was granted by the common council in the face of the active opposition of citizens and property owners, all of whom were entirely disregarded. The franchise is for an electric elevated road, is unlimited as to time, and permits of the running of frieght trains through the city.

Monticello, Ky.—J. C. Slayback, of Hamilton, O., and T. F. McClure, of Cincinnati, have been here lately in the interest of a proposed electric line from this place to Burnside or Somerset.

Muncie, Ind.—Sub-contracts for the construction of the long-projected electric traction road from this city to Ft. Wayne will shortly be let.

Oshkosh, Wis.—It is said that the construction of the Oshkosh, Omro & Berlin Electric Railway will be begun shortly.

Philadelphia, Pa.—Numerous changes and improvements are now under way and in contemplation by various traction companies now operating in outside counties, by which it is proposed to furnish trolley communication between this city and Reading, and possibly Harrisburg.

Pottstown, Pa.—A charter has been granted to the Ringing Rocks Traction Company, which purposes to build a trolley line from the northern limits of this place to connect with the Ringing Rocks road to Boyertown. It will reach the villages of Fagleysville, Morrisville and New Berlinville, and cover nine miles of a thickly settled territory.

Quakertown, Pa.—The Lehigh Valley Traction Company has announced the purchase of the line from Quakertown to Perkasie from the Quakertown & Philadelphia Traction Company. The line is needed as a connecting track between Allentown and Philadelphia.

Toronto, Can.—Work will soon commence on the new London, Aylmer & North Shore Electric Railway.

Traverse City, Mich.—The citizens favor a $20,000 bond issue to aid in the construction of an electric line from here around the peninsula, touching at the Old Mission resort.

Wilmington, Del.—The Wilmington & Brandywine Springs Railway Company has made a deal with Chester County capitalists to build a trolley road from West Chester to the State line to connect with the tracks of the local company, which are to be extended to that point.

Company Matters.

Chicago, Ill.—The Western Electric Company is about to begin the construction of a 10-story building, in connection with its large plant, at a cost of $190,000.

Lancaster, Pa.—The Lancaster County Railway & Light Company has awarded contracts for an electric power plant that will cost $300,000.

Minneapolis, Minn.—The Minneapolis General Electric Company has secured control of the International Electric Company and the latter has gone out of existence.

Power and Transmission.

Columbus, O.—Men of this city are promoting a scheme to harness Cuyahoga Falls and supply power to the surrounding towns, especially Akron, Massillon, Ravenna and possibly Sandusky, in the near future. The company will incorporate for about $1,000,000. The man said to be particularly interested is G. A. Ritchie, who is said to have constructed similar power stations in several South American countries. It is proposed to spend $140,000 for the construction of a dam at the falls and for races to carry the water from a big reservoir.

Fulton, Wis.—Changes are soon to be made in the power plant located here by the Janesville Electric Company. Heretofore the dynamos located at this place have furnished the current for lighting the arc lights in Janesville as well as those in Edgerton. When the new machinery is installed a power current of high tension will be transmitted to Janesville. The Edgerton Electric Company will doubtless install another incandescent machine at Fulton to help out an overload that might occur at the Indian Ford plant.

Mines.

Denver, Col.—The Smuggler-Union Mine has placed orders for a number of new motors and other electrical equipment.—The Utah Fuel Company will henceforth operate the Sunnyside Mine with electricity, generators and motors being ordered recently.

Idaho Springs, Col.—The equipping of mines in this locality with electricity is commencing, and engineers have been in the field, running lines and making estimates for many of the mines. The poles are now up to the Gem Extension Mine, and other properties in the same locality are to be furnished with this kind of power. It is said that the Seaton, Freighters' Friend and Sun and Moon are to be supplied with electricity by the Seaton Mountain Electric Company as soon as the new machinery is received by that company.

Automobiles.

Albany, N. Y.—An electric automobile bus company will soon be formed in this city for the purpose of doing a general bus business with electric vehicles. Mr. Matthew De Freest is the prime mover of the project.

Chicago, Ill.—The Mohrjay Automobile Company, capitalized at $10,000, will construct and operate motors, vehicles, etc. W. V. Thompson, Webb Jay and John Charles Mohr are the interested parties.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: ctf. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Albany, N. Y.–Aug 30						
United Traction (Consolidation of the Albany and Troy City Railway.)	100	$5,000,000	$5,000,000	1½ % Q.,	105	107
Allentown Pa.–Aug 30						
Allentown & Lehigh Val. Trac. Co	...	4,000,000	1,500,000	....	--	15
Bridgeport, Conn–Aug 30:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug.,	100	...
Baltimore Md–Aug 30						
a United Rail ways & Elec. Co...com	50	24,000,000	18,000,000	....	16⅛	16¼
Boston, Mass.–Aug 30						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15,	...	..
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	15	16
North Shore Traction Co........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	85	87
b West End Street Ry. Co.......com.	50	10,000,000	9,085,000	8½ % S., Oct.,	96	96¼
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Jan.	110	110⅛
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 99,	186	187
Brooklyn N. Y.–Aug 30;						
Brooklyn City Ry	100	2,000,000	1,928,400	....	242	244
Brooklyn Rap. Transit Co., tr certf.	100	43,000,000	43,000,000	....	74½	75
cBrooklyn Heights Railroad	....	200,000	200,000	....	107	109
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	3½ % Q., Jan.,	237	239
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	2,000,000	1,884,200	2½ % Nov.,	325	330
Kings County Elevated	....	4,750,000	4,750,000	....	..	...
Kings County Traction Co	100	4,500,000	4,500,000	1 % July	..	..
Nassau Electric Railroad ....pfd.	......	6,000,000	6,000,000	....	82	85
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo N. Y.–Aug 30						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	74	75
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec.	91	92
Columbus O–Aug 30						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb.	37	38
Columbus Street Railroad, pfd	100	1,500,000	1,500,000	....	97	100
Charleston, S. C.–Aug 30						
Charleston City Ry. Co	50	100,000	100,000	3 % S.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.–Aug 30						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31,	250	255
Chicago & South Side R. T. RR	100	10,328,800	10,328,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12¾	13
Metropolitan West Side Elev. Ry	100	15,000,000	7,000,000	Feb 28 1900.	3	36½
Met. West Side El., pfd	100	15,000,000	9,000,000	....	97½	37½
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan.	209	210
hNorth Chicago City RR	100	500,000	249,900	....	200	202
South Chicago City Railway	100	2,000,000	1,608,200	....	108	109
West Chicago St. RR. Co	100	20,000,000	18,189,000	1½ % Q., Feb.	89¾	90
Union Traction Ry...........com	....	1,250,000	624,900	35 %	17	17¼
Union Traction Co............pref	100	2,000,000	2,000,000	5 % S.	60	61
Cincinnati, Ohio.–Aug 30:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	..
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	½ % Feb.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	3,000,000	3,500,000	2½ % Feb.	75	76
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan.	124½	125
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan.	126½	127
Cleveland, Ohio–Aug 30						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan.	48	50
Cleveland City Ry	100	8,000,000	7,600,000	3-5 % Jan.	102	103
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct.,	83	85
Detroit, Mich.–Aug 30.						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	....	1,200,000	....	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	75
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.–Aug 30						
City Railway Co............com.	100	1,500,000	1,470,600	1¼ % Q.	140	145
City Railway Co............pfd	100	600,000	600,000	1½ % Q.	170	..
People's Street Railway	...	1,100,000	1,100,000	....	114	115

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Hartford Conn–Aug 30						
Hartford Street Ry. Co	100	$4,000,000	$300,000	8 % S., Oct.,	150	–
Hartford & West Hartford RR	100	1,000,000	247,000	....	--	–
Holyoke Mass.–Aug 30						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., June,	207½	212
Hoboken N. J.–Aug 30						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %,	180	–
Indianapolis, Ind–Aug 30						
**Indianapolis Street Ry	....	5,000,000	5,000,000	....	25	25½
Lancaster, Pa.–Aug 30						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	--	..
Lancaster & Col. Electric Ry	....	....	87,500	....	--	...
West End Street Railway	....	....	....	....	--	..
Louisville, Ky.–Aug 30:						
Louisville Ry................com.	100	4,000,000	3,500,000	1¼ %., April.	82	83
Louisville Ry................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1,	112	113
Minneapolis, Minn.–Aug 30						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	89	8[illegible]¼
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,712,200	1¾ %. Oct.	186	187
Montreal, Canada.–Aug 30						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	290	291
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S. J. & J. †	109¾	109⅞
Memphis Tenn.–Aug 30						
Memphis Street Railway Co	100	500,000	500,000	....	25	–
New Haven, Conn.–Aug 30.						
Fair Haven & Westville RR	25	2,000,000	2,000,000	3 % S., Sept.	39	41
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July	...	...
New Haven & Centerville	100	700,000	800,000	....	..	--
Winchester Avenue RR	25	1,000,000	600,000	....	45	46
New Orleans, La.–Aug 30						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., July,	..	--
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Oct.	148½	153
New Orleans Traction Co new com.	100	....	....	....	26	28
New Orleans Traction Co new pfd.	100	....	....	....	102	103
aCrescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan.,	20½	26
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan.,	..	--
Orleans Railroad	50	500,000	185,000	1½ %., June,	..	52
St. Charles Street Railway	50	1,000,000	1,000,000	1¼ %. Oct.,	56½	57
New York–Aug 30						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	260
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Oct.,	175	185
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Nov.	120	125
dMetropolitan Street Ry. Co	100	45,000,000	45,000,000	2½ % Q., Feb., 1901.	168¼	169¾
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July,	32	36
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	241	249
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,[illegible]0,000	2¼ % Q.	205	210
hEighth Avenue RR	100	1,000,000	1,[illegible]0,000	....	400	410
i42d St. & Grand St. Ferry RR. guar	100	750,000	[illegible]8,000	4½ % Q.	390	400
jNinth Avenue RR...........guar.	100	800,000	8[illegible]0,000	....	198	205
kSixth Avenue RR............guar	100	2,000,000	2,[illegible],000	....	200	205
lTwenty-third St. R. R. Co..guar.	100	600,000	6[illegible],000	4½ % Q.	400	410
Second Avenue RR	100	2,500,000	1,8[illegible],000	2 % Q., Jan.,	212	215
Third Avenue RR	100	12,000,000	10,0[illegible]000	$1.75 p. sh. Feb.	121	121¼
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,5[illegible]000	....	65	75½
*Union (Huckleberry) Ry	100	2,000,000	2,00[illegible]000	....	190	200
Newark N. J.–Aug 30						
Consolidated Traction Co of N. J.	100	15,000,000	[illegible],000,000	....	69½	70½
North Jersey Railway Co	100	6,000,000	[illegible]000,000	....	24	24½
United Elec. Co. of New Jersey	100	504,000	504,000	11¼ % A.	280½	282
Pittsburg, Pa.–Aug 30						
Allegheny Traction Co	50	500,000		....	27	28
oConsolidated Traction Co....com.	50	15,000,000		2 %, Jan.	20	21
Consolidated Traction Co......pfd.	50	9,473,850		3 %, Nov.	58	59
pCentral Traction Co	50	1,500,000		1½ % Nov.	78⅛	78¼
qCitizens' Traction Co	50	3,000,000		6 % A.	73	74
rDuquesne Traction Co	50	3,000,000		6 % A.	..	...
sPittsburg Traction Co	50	2,500,000		3½ %, Nov.	..½	..
Federal St. & Pleasant Valley Ry	25	1,400,000		2½ %, July,	27	29
Pgh., Allegheny & Man. Trac. Co	50	3,000,000		2 %, Aug.	..	..
Pittsburg & Birmingham Trac. Ry	25	1,500,000		1 %, Oct.	41	42½
Pittsburg & West End Ry	50	3,000,000		5 % A., June	..	..
United Traction Co..............com.	50	17,000,000		J. & J.	18¼	18½
United Traction Co..............pre	50	3,000,000		J. & J.		

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*Unlisted. † Ex div.

a The United Railways & Electric Company comprises in its organization the Baltimore Consolidated Railway Company, the Baltimore City Passenger Railway Company, all the lines of street railway operated by these companies, and also the Central Railway Co of Baltimore. The pref stock of U R & Elec Co has been issued in the form of income bonds.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250 100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railway Company, lessee.

Cincinnati St. Railway purchased the Mt. A. & Eden Park road, assuming its bonds.

*Unlisted. † Full paid. | Outstanding. ‡ Ex-div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Ry. at 8 % on stock until Oct. 1, 1897; thereafter 9 %.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1893, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter.

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 % on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens' Duquesne, Fort Pitt & Pitt'b Traction.

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.

q Leased to Fort Pitt Traction Company for 6 % on $8,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock.

s Leased to Consolidated Traction Company for 7 % on capital stock.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
New Bedford Mass.– Aug 30						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb.	160	165
Northampton, Mass– Aug 30						
Northampton Street Ry	100	800,000	225,000	4 % A., June.	170	178
Omaha, Neb.– Aug 30						
Omaha Street Ry	100	5,000,000	5,000,000	3 % A. and N.	55	65
Paterson N. J.– Aug 30						
Paterson Ry. Co.	100	1,250,000	1,250,000	....	54	--
Providence, R. I.– Aug 30						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Oct.	109	110
Philadelphia.– Aug 30						
Fairmount Park Trans. Co...$50 pd.	50	2,000,000	1,770,000	2 %, Dec.	23	24
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15,	47	48
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	583,900	‡583,900	3 % S—July,	75	76
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1,	26½	27
Union Traction Co....$17¼ pd	50	30,000 000	29,930,450	....	26¾	27
bElectric Traction Co.	50	....	8,297,920	....	..	...
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	345	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.	450	451
fLehigh Avenue Ry. Co	50	1,000,000	....	....	48	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	90	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar.	309	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April,	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—	150	151
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan.,	151	152
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	....	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh. Oct.	97⅝	97¾
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar.,	..	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖380,000	$6 share—July	158	157
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July	208	208¼
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$8.50 share July	100	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July	308¾	309
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '	..	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖385,000	$11 sh. A., July,	300	..
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July	239	240
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '	262	268
Rochester, N. Y.– Aug 30						
Rochester Railway Co	100	5,000,000	5,000,000	....	25	28
Reading, Pa.– Aug 30						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	24	26
kCity Passenger Ry	50	850,000	850,000	Jan.,	133	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan.,	70	--
St. Louis Mo.– Aug 30						
Fourth Street & Arsenal Ry	50	300,000	150,000	....	--	--
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec.	--	--
Lindell Ry	100	2,500,000	2,400,000	1¼ % Jan.	--	--
National Railway Co	--	2,500,000	2,479,000	1½ % Jan.	--	--
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	--	--
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct.,	--	--
St. Louis RR	100	2,000,000	2,000,000	2½ %, Jan.,	...	--
Missouri RR	50	2,400,000	2,300,000	1½ % Jan.,	--	--
People's RR. Co	50	1,000,000	300,000	50c., Dec.,	..	...
United Electric Ry....com.	50	500,000	500,000	....	27	27½
United Electric Ry....5 % pref.	100	1,000,000	1,000,000	3 %, Jan.,	79½	81
St. Louis & Suburban Ry	100	3,000,000	2,500,000	....	90	95
Union Depot RR	100	4,000,000	4,000,000	3 % A., July,	--	--
San Francisco, Cal.– Aug						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	117	119
Geary Street Park & Ocean RR	100	1,000,000	375,000	$2.50 share,	60	..
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	61½	63⅛
Presidio & Ferries RR	100	1,000,000	550,000	....	--	16
Scranton Pa– Aug 30						
Scranton Railway Co	50	6,000,000	2,500,000	....	29	30
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	16½	...
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	--	--
Springfield Ill.– Aug 30						
Springfield Consolidated Ry	100	750,000	750,000	....	....	--
Springfield O.– Aug 30						
Springfield Street Ry	100	1,000,000	1,000,000	....	--	11
Springfield, Mass.– Aug 30						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	207	212
Toronto Canada.– Aug 30						
Toronto Street Ry	100	6,000,000	6,000,000	1¾ % S.	109¼	110½
Montreal Street Railway Co	.....	4,000,000	4,000,000	4 % S.	279	280
Washington, D. C.– Aug 30						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct.	103¾	103⅞
Columbia Ry. Co	50	400,000	400,000	6 % A.	--	...
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	35	40
Georgetown & Tenallytown Ry	50	200,000	200,000	....	20	21
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	--	--
Worcester, Mass.– Aug 30						
*Worcester Traction Co....com.	100	8,000,000	8,000,000	....	32¼	35
Worcester Traction Co....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb.,	107	108
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %,	...	85
Wilkesbarre, Pa.– Aug 30						
Wikesbarr & Wyoming Val Trac	100	5,000,000	5,000,000	1%, Jan..	25	26

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex-div.

a Leased to Hestonville, Man & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Company at a rental of $10,000 per annum in 1866-7-8, p a. $20,000 in 1899-1900 and $30 000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6 % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Co., formerly Scranton Traction Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Boston, Mass.– Aug 30						
American Tel & Tel Co	100	50,000,000	28,650,000	4½ % Q., Jan.	169	169½
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Feb. 20,	45	46
New England Telephone Co	--	10,894,600	10,894,600	$1.50 p. sh. Feb	138	138½
New York.– Aug 30						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	91	94
*Central & South Am. Teleg. Co.	100	6,500,000	6,500,000	1½ % Q.	105	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	173	175
Franklin Teleg. Co.....2½ % guar.	100	1,000,000	......	1¼ % S.	42	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Feb.,	..	..
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	108	109
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	116	118
Mexican Telephone Co	100	2,000,000	......		2	2½
*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	2½ % Q., Jan.,	168	178
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	70	75
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	100	110
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan.,	115	..
Western Union Telegraph Co	--	......	97,370,000	1¼ %, Q, Jan.	93¼	94
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.– Aug 30						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q.	26	37
Bell Teleph. Co. (of Canada.)	100	3,960,000	3,564,000	2 % S.	188	..
Chesapeake & Potomac Telep. Co.	100	......	......	....	67	70
Chicago Telephone Co	100	......	......	......	200	210
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	148	150
Empire & Bay States Telegraph Co.	...	......	......	....	75	76
Hudson River Telephone Co	109	2,000,000	2,000,000	1 % Q.	120	125
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	122	126
Providence (R. I.) Teleph. Co.	50	......	......	....	96	97
Southern New Eng. Teleph. Co	100	8,000,000	......	....	...	--

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.– Aug 30						
Fort Wayne Electric trust receipts	..	......	......	....	115	125
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	15	25
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	
General Electric Co. [new]...... "	100	18,276,000	18,276,000	2 % Q., July, 1901	267¼	268
T.-H. Elec. Co..T. Secur., Series C.	..	......	......	....	22	23
Westinghouse Elec. & Mfg. Co. com.	50	......	146,700	....	70½	71
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q.,	79¾	80
Westinghouse El. & Mfg. Co. rights.	50	11,000,000	8,195,126	......	1¾	1⅞
New York.– Aug 30						
Edison Elec. Ill'g Co., New York.	100	9,188,000	7,938,000	....	119	120
*Edison Elec. Ill'g Co., Brooklyn.	100	4,000,000	2,000,000	1½ % Oct., '98.	--	..
Edison Ore Milling Co	100	......	......	....	8	12
Electric Vehicle Co.....com.	..	......	......	....	--	--
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	...
General Electric Co. [new].... "	100	18,276,000	18,276,000	2 % Q., July, 1901	267¾	268
Interior Conduit & Insulation Co.	100	1,000,000	1,000,000	....	41	--
‖Kings Co. El. L. & P. Co.	100	2,500,000	2,500,000	A. & O.	110	125
Pittsburg, Pa– Aug 30						
Allegheny County Light Co	100	500,000	500,000	J. & J.	168	172
East End Electric Light Co	50	300,000	300,000	Q	--	--
Philadelphia, Pa.– Aug 30						
Edison Electric Light Co	100	2,000,000	......	......	144	144½
*Electric Storage Battery Co..com.	100	8,500,000	......	......	76	79
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	76	80
Northern Elec. Light & Power Co.	10	550,000	550,000	......	13	13½
Southern Elec. Light & Power Co.	10	187,500	187,500	....	30	--
Miscellanoeus.– Aug 30						
Bridgeport (Conn.) Elec. Lt. Co.	25	500,000	......	......	47	48
Missouri-Edison (St. Louis)....com.	..	......	......	....	20	21
Eddy Electric Mfg. Co	25	......	......	....	9	10
Hartford (Conn.) Elec. Light Co.	100	350,000	......	....	190	191
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	9	10
New Haven (Conn.) Elec. Lt. Co.	100	100,000	......	....	195	
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct.,	93	94
Rhode Island Elec. Protec. Co	100	......	......	....	118	120
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q	‡250	251
Toronto (Canada) Elec. Light Co.	100	1,085,000	1,085,000	1¾ % Q	136	138
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1,	..	100
Woonsocket (R. I.) Electric Co	100	......	......	....	105	106

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

‖ Recently acquired the Edison Illuminating Co. of Brooklyn and its constituent company, the Municipal Electric Light Co.

ALLIED INDUSTRIES.

Boston Mass.– Aug 30.						
American Electric Heating Co	50	10,000,000	....	....	--	--
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh.	--	--
United Electric Securities Co...pfd.	100	......	1,000,000	$3.50 p.sh.	--	100
New York.– Aug 30:						
Consolidated Electric Storage Co.	...	......	....	....	8	12
Safety Car Heating & Lighting Co.	100	......	....	......	150	155
Worthington Pump Co.........com.	100	5,500,000	5,500,000	......	..	--
Worthington Pump Co.........pfd	100	2,000,000	2,000,000	7 % A	113	114
Philadelphia Pa.– Aug 30						
Electro Pneumatic Trans. Co	10	1,500,000	......	--	1⅛	1¾
United Gas Improvement Co..scrip.	50	10,000,000	......	--	..	162
Welsbach Commercial Co.....com.	100	3,500,000	......	--	20½	21½
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	73	75
Welsbach Light Co	5	525,100	......	....	54	55
Welsbach Light Co., Canada.	5	500,000	......	....	1	1½
Pittsburg, Pa.– Aug 30						
Carborundum Mfg. Co	100	200,000	200,000	....	--	
Standard Underground Cable Co.	100	1,000,000	1,000,000	Q	224	227
Miscellaneous.– Aug 30						
*Barney & Smith Car Co.......com.	100	......	1,000,000	--	20	25
*Barney & Smith Car Co........pfd.	100	......	500,000	2 %	120	129
Billings & Spencer Co	25	......	....	....	10	15
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb	54	56½
Johns-Pratt Co	100	....	....	--	105	109
*Pratt & Whitney Co...........com.	100	......	....	--	..	
*Pratt & Whitney Co...........pfd	100	....	......	--	85	90
Stillwell-Bierce Co.............com.	--	....	....	--	..	50
Stillwell-Bierce Co.............pfd.	--	....	....	2 % Sept	65	70
Shultz Belting Co	100	500,000	....	....	86	90
St. Charles Car Co		------	------	----	80	88

* Unlisted.

BONDS.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany N. Y.						
Date of Quotation—Aug 30, 1901						
The Albany Ry. Co……Cons. mtg. 5s	$500,000	427,500	1940	J. & J.	117⅛	……
‡The Albany Ry. Co……Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*116⅛	……
†Watervliet Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*125	….
‡Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*124	126
Troy City Railway Co…………1st 5s	….	….	1942	……	*116⅛	118
†Interest guar. by Albany Ry. Co.						
‡Principal and interest guar. by Albany Ry. Co.						
Baltimore Md.						
Date of Quotation—Aug 30 1901						
United Electric Ry. Co…1st mtg. g. 4s	88,000,000	18,000,000	1949	M. & S.	102	102¼
" " " ………income 4s.	14,000,000	…………	1949	J. & D.	74¾	75
Baltimore City Pass. Ry..1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	118⅞	
†Baltimore Traction Co……1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	119	120
†Baltimore Trac. Co. Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	104⅛	……
†Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	121	121⅛
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	………	1900	J. & J.	101	……
†Baltimore Traction Co. Convertible 5s.	800,000	………	1906	N. & M.	102⅛	……
†Central Pass. Ry. Co………1st mtg. 6s.	96,000	117,000	1912	J. & J.	…..	….
†Central Pass. Ry. Co..Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	119	121
†City & Suburban Ry……1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	116	117
†Lake Roland Elev., …………1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	117	……
☞ All of the bonds of the above companies, marked †, have been assumed by the United Railways & Electric Company.						
Boston Mass.						
Date of Quotation—Aug 30, 1901.						
†Lynn & Boston RR……1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	114	115
West End Street Ry………Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104⅛	106
West End Street Ry……Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	112	….
†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.						
Charleston S. C.						
Date of Quotation—Aug 30, 1901.						
†Enterprise Street RR………1st mtg. 5s.	500,000	47,000	1906	J. & J.	….	….
†Charleston City Ry…………1st mtg. 6s.	850,000	….	….	J. & J.	106	….
†Controlled by Charleston St. Ry. Co.						
Chicago Ill.						
Date of Quotation—Aug 30, 1901.						
Chicago City Ry…………1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¾	2¾
‡Chicago Passenger Ry……1st mtg. 6s.	400,000	400,000	1908	F. & A.	….	102
‡Chicago Passenger Ry…Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	……	….
¶Chicago & So. Side R. T…1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	….	….
Chicago & So. Side R. T…………4½s.	1,500,000	750,000	1907	J. & J.	….	……
‖Chicago West Div. Ry……1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	108⅛	109
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	….	……
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	96	96⅛
North Chicago St. RR………1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	106	……
North Chicago St. RR….Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	….	……
North Chicago City Ry……1st mtg. 6s.	500,000	500,000	1900	J. & J.	..	……
North Chicago City Ry……consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	108	……
West Chicago St. RR………1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	……	111
West Chicago St. RR………Deben. 6s…	2,700,000	700,000	1911	J. & D.	101	102
West Chicago St. RR….Con. mtg. g. 5s.	12,500,000	6,000,000	1936	……	106⅝	107
‡W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	….	….
†Redeemable at option on 60 da. notice.						
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.						
¶Subject to call after Oct. 1, 1899, at $110 and interest.						
‖Assumed by W. Chi. RR. Co., lessee.						
‡Int. guar. by W. Chicago St. RR. Co						
Cincinnati O.						
Date of Quotation—Aug 30 1901.						
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	114⅛	115
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108⅛	104
†Mt. Adams & Eden P'k In…1st mtg. 6s.	100,000	100,000	1905	A. & O.	114	……
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	581,000	581,000	1906	M. & S.	108¾	……
So. Cov. & Cin. St. Ry………1st mtg. 6s.	250,000	250,000	1912	M. & S.	121⅛	122⅛
‖So. Cov. & Cin. St. Ry……2d mtg. 6s.	400,000	400,000	1932	J. & J.	132¾	137
†Assumed by the Cincin. St. Ry. Co.						
‖$250,000 reserved to retire 1st mtg. bds.						
Cleveland O.						
Date of Quotation—Aug 30, 1901.						
aBrooklyn Street RR. Co……1st mtg. 6s.	600,000	600,000	1908	M. & S.	106⅛	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	113⅛	114¾
Cleveland City Cable Ry….1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	105⅛	106
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	106	107
Columbus (O.) Cent. Ry…1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	……	……
aEast Cleveland RR…………1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	……	107½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	………	1922	M. & N.	……	….
Lorain (O.) Street Ry………1st mtg. 6s.	200,000	200,000	1915	J. & J.	……	….
‡St. Ry. Co., Grand Rapids…1st mtg. 5s.	600,000	600,000	1912	J. & D.	….	….
†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.						
‡Interest guar. by Cons. St. Ry. Co.						
Detroit, Mich.						
Date of Quotation—Aug 30, 1901						
†Detroit Citizens' St. Ry……1st mtg. 5s.	7,000,000	3,385,000	1905	A. & O.	……	102⅛
Ft. Wayne & Belle Isle Ry…1st mtg. 6s.	400,000	377,000	1902	A. & O.	….	….
The Detroit Ry………………1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	105	106⅛
†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						
New Haven Conn.						
Date of Quotation—Aug 30 1901						
New Haven St Ry…………1st mtg. g. 5s…	600,000	600,000	1918		111	….
New Haven, Edgewood Div., 1st mtg. 5s.	250,000	250,000	1914	J & D	111	……
Winchester Avenue RR., 1st mtg. g. 5s..	100,000	500,000	1912	M & N	109	……
Winchester Avenue RR…… Deben 5s.	100,000	24,030	1912	M & S		
New Orleans La.						
Date of Quotation—Aug 30 1901.						
Canal & Claiborne RR… cons mtg. 6s.	$150,000	$150,000	1912	M. & N.	……	….
Crescent City RR…………1st mtg. 6s.	…….	50,000	1899	M. & N.	105⅛	……
Crescent City RR……Cons. mtg. g. 5s.	5,000,000	3,000,000	1948	J. & J.	……	….
New Orleans City RR………1st mtg. 6s.	416,500	399,000	1908	J. & D.	108	112
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1948	J. & J.	112	113
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	……	……
Orleans Railroad Co……Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	……	……
‡St. Charles St. RR. Co……1st. mtg. 6s.	800,000	75,000	1906	J. & D.	……	……
†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.						
‡$90,000 outstanding.						
New York.						
Date of Quotation—Aug 30 1901.						
Atlantic Ave. (Brooklyn)….Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	……
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107⅛	110
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	115	116
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	123	125
Broadway & 7th Ave………1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	105⅛
Broadway & 7th Ave………2d mtg. 5s.	500,000	500,000	1914	J. & J.	108	110
Broadway Surface…………1st mtg. 5s.	1,125,000	1,125,000	1924	…….	115	117
Broadway Surface…………2d mtg. 5s.	1,000,000	1,000,000	1905	…….	105	106
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	115	116
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	101	….
Brooklyn Heights RR……1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	……
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	112	….
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	107	….
Brooklyn Rapid Transit………gold 5s.	7,000,000	5,181,000	1945	………	109⅛	……
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	…….	98⅛	100⅛
Cent P'k, N. & E. R. RR. 1st cons. mtg. 4s.	1,200,000	1,200,000	1902	J. & D.	107	109
Central Crosstown RR………1st mtg. 6s.	250,000	250,000	1922	M. & N.	125	……
Coney Island & Brooklyn RR. 1st mtg. 5s	800,000	800,000	1903	J. & J.	101	103
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1932	J. & D.	117	120
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	100,000	1,100,000	1914	F. & A.	102	105
Eighth Av. RR. Co……Cert. indebt. 6 %.	000 000	1,000,000	1914	F. & A.	108	….
42d St., Man. & St. Nich. Av..1st mtg. 6s.	,200,000	1,200,000	1910	M. & S.	116⅛	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	89	……
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	124	125
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	120	……
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	120	121
Second Avenue Ry……………Deb. 5s.	800,000	800,000	1909	J. & J.	108⅛	109
Steinway Ry. (L. I.)……1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	116	117
South Ferry RR. Co…………1st mtg. 5s.	850,000	850,000	1919	…….	110⅛	112⅛
Third Avenue RR…………1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	……	128⅛
Twenty-third Street Ry……1st mtg. 6s.	………	………	1909	J. & J.	…..	….
Twenty-third Street Ry…………Deb. 5s	150,000	150,000	1906	J. & J.	106	108
Union (Huckleberry) Ry……1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	118	116
‡‡Westchester Electric RR…1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	114
†$1,035,000 in escrow to retire gen. mtg. bonds.						
‡$4,850,000 in escrow to retire maturing obligations.						
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.						
§In treasury, $80,000.						
‡‡ Guar. by Union Ry. Co.						
Toronto Canada.						
Date of Quotation—Aug 30 1901						
Montreal St. Ry…………………1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	….	--
†Toronto St. Ry…………1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M & S.	….	--
†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.						
Philadelphia.						
Date of Quotation—Aug 30, 1901						
Continental Pass. Ry…………1st. mtg. 6s	850,000	810,000	1909	J. & J.	….	….
Empire Pass. Ry……………………1st mtg. 7s	800,000	200,000	1900	J. & J.	….	….
Greene & Coates St. Ry………1st mtg. 6s	100,000	100,000	1898	J. & J.	….	….
Lombard & So. St. Pass. Ry…1st mtg. 6s	150,000	………	1901	…….	….	….
People's Pass. Ry………………1st mtg. 7s	250,000	250,000	1905	J. & J.	….	….
People's Pass. Ry………………2d mtg. 5s	500,000	458,000	1911	J. & J.	….	….
People's Pass. Ry…………Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	….	….
People's Pass. Ry……Stk. trs. cert. g. 4s	5,698,210	……	1943	…	….	….
Phila. City Passenger Ry……1st mtg. 5s	200,000	200,000	1910	J &	……	….
Philadelphia Trac. Co………Coll. tr. g. 4s.	1,800,000	1,018,000	1917	F. & A.	……	……
Thirteenth & 15th St. Ry……1st mtg. 7s.	100,000	100,000	1903	A. & O	….	….
Union Passenger Ry……………1st mtg. 5s	500,000	500,000	1911	A. & O.	….	….
§Union Traction Co……………Col. tr. 4s.	29,785,000	29,724,876	1945	A. & O.	--	……
West End Passenger Ry…… 1st mtg. 7s.	………	……	1905	……	….	….
West Phila. Pass. Ry………1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	……	….
West. Phila. Pass. Ry…………2d mtg. 5s.	750,000	750,000	1926	M. & N.	……	……
§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
Pittsburg, Pa.						
Date of Quotation—Aug 30 1901						
Birmingham, Knox & Allentown……6s.	500,000	500,060	1931	M. & S.	111⅛	….
Central Traction Co……………1st mtg. 5s.	875,000	875,000	1930	J. & J	……	……
Citizens' Traction Co…………1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	……	……
*Duquesne Traction Co………1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	….	……
*Fed'l St. & Pleas. Val. Jack's Run……5s.	50,000	50,000	1918	J. & J.	……	……
Fed'l St. & Pleasant Valley………Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	……	….
Millvale, Etna & Sharpsburg……………5s.	750,000	750,000	1928	M. & N.	110	118
Pittsburg, Crafton & Mansfield…………5s.	250,000	250,000	1924	J. & J.	……	….
Pittsburg Traction Co…………1st mtg. 5s.	750,000	750,000	1927	A. & O.	……	….
Pittsburg & Birmingham……1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	118
Pittsburg & West End………1st mtg. 5s.	500,000	500,000	1922	J. & J.	….	……
*Pg'h., Allegh. & Manch…..Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	….	……
Second Ave. Traction Co…………………5s.	2,500,000	2,039,006	1934	J. & D.	……	……
Sub. Rapid Transit Railway Co…………6s.	500,000	500,000	1918	M. & S.	……	……
Providence R. I.						
Date of Quotation—Aug 30 901						
Newport Street Ry………………Coupon 5s	50,000	50,000	1910	J. & D.		
United Trac. & Elec. Co…..1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	116	118
St. Louis.						
Date of Quotation—Aug 30, 1901.						
Baden & St. Louis RR………1st mtg. 5s	250,000	250,000	1918	J & J	101⅛	… …
Cass Ave. & Fair Gds Ry……1st mtg. 5s	1,818,000	1,818,000	1912	J & J	101⅛	……
Citizens' Railway Co……1st mtg. 5s	2,000,000	1,500,000	1907	J & J	109	
Comp. Hts. Un. De. & Mer. Ter..1s	1 000 000	000 000	191	J& J	11	

With interest Unlisted

Unlisted With interest

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis. Date of Quotation—Aug 30 1901.						
Jefferson Avenue Ry.........1st mtg. 5s.	270,000	270,000	1906	M. & N.	102	108
Lindell Ry. Co.........1st mtg. 5s	1,500,000	1,500 000	1911	F. & A.	107	108
Missouri RR. Co..............	1,000,000	700,000	1916	M. & S.	105	106
‡Mound City RR. Co.........1st mtg. 6s.	400,000	300,000	1910	A. & O.	104½	105¼
People's RR. Co.........1st mtg. 6s.	125,000	125,000	1902	J. & D.	....	......
‖People's RR. Co.........2d mtg. 7s.	75,000	75.000	1902	M. & N.	......	......
People's RR. Co.........Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	......	......
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.........1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	99¼	100¼
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry.........Income 5s.	800,000	800,000	......	....	80	84
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	106	108
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	116½	117½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	100	100⅛
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	121	122
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal. Date of Quotation—Aug 1901.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	117
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	......	95
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	126¼	......
†Metropolitan Ry. Co.........1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co.........1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126¼	......
†Park & Cliff House RR.........1st mtg. 6s.	850,000	850,000	1912	J. & J.	105½	107
†Park & Ocean RR.........1st mtg. 6s.	250,000	250.000	1914	J. & J.	115	......
†Powell St. Ry.........1st mtg. 6s.	700,000	700,000	1912	M. & S.	.....	125
Sutter St. Ry. Co.........1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C. Date of Quotation—Aug 30. 1901						
Belt Ry. Co.........Cons mtg 5s.	500,000	450,000	1920	J. & J.	......	....
Columbia Ry.........1st mtg. 6s.	500,000	500,000	1914	A. & O.	132	......
Eckington & Soldiers' Home, 1st mtg. 6s.	200,000	200,000	1911	J. & D.	......	......
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	......	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous. Date of Quotation—Aug 30, 1901						
Bridgeport Traction Co.........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	108	110
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	118	. ..
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	104	105
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,866,000	1932	M. & N.	112	113
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	115	......
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	111¼	111⅜
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	115	115¼
Denver City Cable Ry.........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	20	..
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	85
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	119	119¼
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	110¼	110¾
††No. Hudson Co. Ry. (N.J.). Cons. mtg. 5s	3,000,000	2,878,000	1928	J. & J.	108	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	....	......
Rochester (N. Y.) Ry.........1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	......	......
St. Paul City Ry.........Cons. g. 5s.	5,500,000	4,298,000	1937	....	105¼	106
St. Paul City Ry.........Deb. g. 6s.	1,000,000	1,000,000	1900	....	108	....
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rs	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass. *Date of Quotation—Aug 30, 1901.						
Delaware Gas Lt. Co.,.........1st m. 5s, g.	800,000	800,000	......	J. & J.	106	108
Edison Elec. Illuminating Co., Boston....	2,026,000	....		Quar.	157	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	116	......
Pittsburg Pa Date of Quotation—Aug 26. 1901						
Allegheny County Light Co.........6s.	500,000	......	1911	J. & J.	110	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	....	......	M. & S.	....	......
Miscellaneous.—(Aug 30 1901.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	109	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	124	......
Edison Elec. Illg. Co. (Brooklyn).......	5,000,000	5,000,000	1940	....	122½	124
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	. ..	......
Kings Co. El. Lt. & Pow. Co. 1st mtg. 5s.	2,500,000	......	1937	A. & O.	100	105
Kings Co. El. Lt. & Po. Co. pur. money 6s	5,176,000	....	1997	A & O.	120	122
Milwaukee El. Ry & Lt. Co. 1st con. g. 5s.	8,000,000	....	......	F. & A.	102⅛	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. Date of Quotation—Aug 30. 1901.						
American Bell Telephone.........4s.			1908	F. & A.	100⅛	101 ....
Northwestern Telegraph Co.........7s.	....	....	....	......	....	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	....	....	......	114	115
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	103	106

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. Date of Quotation—Aug 30 1901.						
American Electric Heating.........7s	500,000	500,000	....	....	....	......
Armington & Sims Engine Co.........	....	....	......	......	......	25
Barney & Smith Car Co.........6s.	....	....	1942	J. & J.	106	107
Carborundum Mfg Co.........6s.	....	....	1904	J & D.	......	......
Worthington Pump Co.........	75,000	....	......	....	115	127

Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 16⅝@16¾c.; Lake, 16¾@17c.; casting, 16½@16¾c.

There will be disbursed in Boston in September for interest and dividends $5,188,994.

The dividends declared from January 1 to September 1 on industrial securities amount to $178,535,777.

The Minneapolis General Electric Company has gained control of the International Electric Company by a purchase of its bonds.

Negotiations will shortly be renewed looking to the merging of the American Railways and Electric Company, of America but on a new basis.

The Welch Light, Heat and Equipment Company of Baltimore has been incorporated with a capital of $5,000,000, of which $5,000 has been paid in.

Several constituent companies of the Washington (D. C.) Traction Company have sued the City and Suburban Railway Company for $225,000, money advanced.

Bankers say that they expect the money market to become gradually firmer during the next few weeks, and they are, therefore, inclined to strengthen their positions.

The Lowell and Boston Street Railway Company has petitioned the Railroad Commissioners for authority to issue $90,000 4½ per cent. 20-year gold first mortgage bonds.

An official of the Philadelphia Union Traction Company says: "The company cannot afford to grant an increase from 18 to 20 cents an hour in wages asked for by employes and the men know it. If we did pay them the advance they want it would cost us about $700,000 a year, or nearly $2,000 a day."

The following are quotations for some of the industrial stocks not quoted elsewhere: Electrical Lead Reduction, 1½@1⅝; Electric Boat, 19@22; Electric Vehicle, 5@5½; Tel. & Tel. Company of America (full paid), 3@5; Electric Company of America, 7¼@7½; National Carbon, 17½@17¾.

The Everett-Moore syndicate has closed a deal for the Windsor and Amherstburg Electric Railway and the People's Electric Light Plant, of Winsdor, Ont. The purchase price is $591,000, $21,000 cash having been paid to bind the bargain. J. C. Hutchinson, vice-president of the Detroit United Railway, negotiated the purchase.

The directors of the Chicago City Railway Company have declared a dividend of 2¼ per cent. on the increased stock, payable September 30. While this is at the rate of 9 per cent. a year, it is understood that no decision has been reached as to the permanent rate of dividend on the stock and the next payment may be different from the present one. When on July 1 the stock was increased from $13,500,000 to $18,000,000, the proceeds of the new issue were used to retire $4,619,500 of 4½ per cent. bonds which matured on that date. The company has this saving of interest and could easily pay 10 per cent. on its stock, unless it was decided to save up a cash surplus.

A leading copper interest in New York says: "The immediate future of the copper market is assured. The producers are working under constant pressure to meet the demands. The price of 17 cents for lake and 16⅝ for electrolytic still holds and probably will be maintained for some time. The foreign demand is beginning to run ahead of expectations and a tremendous demand for export will soon be in evidence. Orders for immediate export shipments are coming in in greatly increased volume daily. For the last six months, all the supply could have been disposed of by home consumption and the amount sent abroad was taken from local needs."

The Binghamton Gas Company, of Binghamton, N. Y., has been absorbed by the American Light and Traction Company, of which Emerson McMillin is president. Stockholders in the former company have until September 20 to deposit their holdings with the Trust Company of America, of New York, or the Michigan Trust Company at Grand Rapids, Mich. The American Light and Traction Company is capitalized for $40,000,000, of which $15,000,000 is common stock. Other companies that have been absorbed by the company are the Western Gas Company, of Milwaukee; Grand Rapids Gas Light Company, of Grand Rapids; Madison Gas and Electric Company of Madison, Wis.; St. Joseph Gas Company of St. Joseph, Mo., and the Southern Light and Traction Company, of San Antonio, Tex.

No meeting of the General Electric directors has yet been called to take action on the quarterly dividend on the common stock or to further consider the question of a stock dividend. The total amount of stock which it would be necessary to issue ultimately in order to return to the stockholders the cut of July, 1898, would be 66⅔ per cent. of their present holdings, say about $16,500,000 new stock, assuming all debentures and preferred stock to be exchanged into common stock. In any stock distribution, only such an amount of stock can be actually issued as is equalled by the actual surplus of the company. This surplus on January 31 last stood at $6,629,180 having been increased $4,276,150 in the operations of the company for the year ended January 31, 1901.

According to the "Chronicle Telegraph," a new story is current in connection with Pittsburg Consolidated Traction. "It is rumored that the Mellons, whose traction interests are already large, have offered to buy control of the Consolidated Traction system on the basis of $30 a share for the common stock and $60 a share for the preferred. This rumor is amplified by combining all the Mellon suburban lines with the Consolidated, and adding thereto the lines to be constructed on the North Side, charters for which have been obtained and franchises granted. This would give the Mellons control of all the traction lines of the two cities and suburbs with the exception of the Southern Traction (the old West End system) and the United Traction, which is controlled by the Philadelphia Company through the ownership of the common stock."

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EDITORIAL NOTES.

Wireless Telegraphy

As a means of signaling between ships at sea or between a ship and the mainland, wireless telegraphy is being adopted more and more. It was only a few years ago, that Marconi announced that he could transmit intelligible messages through space without a conducting medium other than the ether, yet to-day several of the ocean liners are equipped with wireless telegraphy apparatus, and the principal navies of the world are making use of Marconi's invention. To what extent wireless telegraphy is being made use of on ships of war may be gathered from the United States Naval Annual, "Notes on Naval Progress," for the year ended July 1, 1901, just issued.

Among other things the experts of the Intelligence Office state that during the early development of wireless telegraphy it was soon realized that its use would be largely for maritime and military purposes. The engineers having the matter in charge then proceeded with this idea in view, and have perfected their instruments for communication between ships, between ships and lighthouses and stations on shore, and between islands where the laying of a cable is a difficult operation. It is of especial interest to naval officers, owing to the success with which long-distance communication has been maintained over the water, its great possibilities for navigating purposes and for use on scouting vessels and its independence of weather, fog, snow, rain or darkness. Great progress has been made during the last year, mainly in the following points: (1) Tuned and multiplex wireless telegraphy. (2) Increased distance over which messages can be transmitted.

One of the great disadvantages for naval purposes has been that privacy of messages could not be secured, and in the fact that messages could be rendered unintelligible by working another transmitter within the field of the waves. Mr. Marconi claims to have succeeded in tuning his receiving instruments so that they respond only to tuned transmitters. To prove the success of his system two messages were sent from St. Catherine Point, one in English and one in French. The receivers at Poole were connected to the same air wire, about 40 feet in length, and each rolled out the message on its tape, that in English on one and that in French on the other. While these experiments were being carried out, others for the British Admiralty were taking place between Portsmouth and Portland. These lines of communication intersected each other, but no interference or confusion of messages resulted.

When the German squadron, after its trip out to China, arrived off one of the ports the British admiral there sent a wireless message for a boarding officer to visit the German flagship and offer the usual civilities. Upon the boarding officer's arrival he was informed by the German officers that the message had been read. On another occasion the officers of an English ship were surprised, while experimenting in the Mediterranean, to receive a message in Italian asking as to the position of the ship. This message came from an Italian man-o'-war, and its receipt and the interception of the message mentioned above, show the importance of tuned instruments for naval purposes. All of these ships were supplied with the older form of wireless apparatus and were unable to preserve secrecy.

These difficulties are now practically overcome, and the extension of the use of various wireless systems amounts to an exciting race between all the navies and the commercial lines. Among the foreign Governments which are establishing systems or contracting for apparatus for naval use are Chili, Denmark, England, France, Russia, Germany, Italy, Japan, Spain and Sweden.

* * *

A Proposed Permanent Exhibit in Mexico.

In view of the fact that our trade in electrical machinery with Mexico increased from a total value of $131,730 in 1899 to $445,268 in 1900, and the further fact that the outlook for American trade with our sister republic was never so bright as at the present time, the announcement that a movement is on foot in the City of Mexico to establish a permanent display of American manufactures will be hailed with satisfaction on the part of electrical manufacturers who may wish to participate in the growing trade of that progressive country. It has also been suggested that a similar display of the products of Mexico be placed in one of the leading cities of this country. By this means it is believed that not only would the importation of goods from the United States be greatly increased, but that much of the trade which is now controlled by European manufacturers can be diverted. Mexican buyers have become so used to purchasing goods of European make, due in a great measure to the effective missionary work on the part of European manufacturers, that they seldom think of looking at those from the United States. This country, to the minds of most of them, is a place from which to get a few electrical inventions, a few staple articles, etc., but for the thousand and one things which are needed there, but are not made in that country, the merchant looks to the European manufacturer.

American manufacturers are gradually waking up to the chances which exist for them in Mexico, and the permanent exhibit is being talked of and seriously considered. It would not necessitate any great expense, and it would be a constant object lesson to the Mexicans of what they can get from their great neighbor on the north. Many Mexican business men who have been approached and questioned as to the practicability and probable success of such an enterprise have favored it, and the United States manufacturers to whom the subject has been broached are also well inclined. Railroad men, too, are confident that great good would come from such a thing for the Americans.

The electrical fraternity, always alive to any plan whereby our export trade in electrical goods may be increaed, will no doubt be in the front rank in this movement.

* * *

The Miami and Erie Canal Towing System.

Construction work has been commenced on the Miami and Erie Canal Railway. The work is being done by Thomas N. Fordyce who has been granted a lease by the State of Ohio to build a line on the towpath for haulage by electricity of canal boats.

In view of the fact that a serious movement for the abandonment of the canals was made in the last session of the Ohio Legislature and promises to be revived in the next, this traction-canal enterprise is very important. It may result in making the canals at least pay for themselves. The deficiency last year was, according to local papers, $83,967.61.

The lease of the Miami Canal does not contemplate the curtailing of the rights of towage by the old mule method, but it is expected that when the railway is completed most everyone will use the trolley line.

Referring to this subject Chief Engineer Perkins in his last report says:

"It has only been within the last few years that the skill and energy of inventors and capitalists have been seriously directed to the improving and cheapening of old methods of hauling on canals.

"This has been brought about by the necessity for keeping pace with other common carriers, and by a commercial demand to so cheapen the cost of canal haulage that it may again become a controlling factor in the regulation of freight rates, especially on such products as will not suffer by being long in transit.

"For some time inventors and practical boatmen have been turning their attention to an attempt to adapt screw propellers and paddle wheels to canal boat propulsion, thus far with uncertain results.

"In 1894 I had the honor, as your representative, of attending a test of this kind on the Erie Canal of New York, presided over by the Hon. F. W. Hawley of the Niagara Falls Electric Company, under special appointment of Governor Flower, at which time it seemed to be demonstrated to the satisfaction of nearly all of the engineers and electricians present that the only practical way to propel a canal boat was by means of a tow line, the method now commonly in use, and the substitution for the horse and mule, an electric locomotive to run along the bank of canal—in fact, an electric mule."

As is generally known, by the proposed system of propulsion for the Miami and Erie Canal, the boats will be drawn by trolley cars running in a standard gauge track laid on the towpath. According to a Western contemporary the motor cars will be equipped with 150 horse-power motors and will be capable of hauling ten heavily loaded canal boats at a speed of ten miles an hour. This speed will not be maintained, however, the State charter stipulating a uniform speed of four miles per hour. The cars will be 7 ft. 10. in. long and will be about 5½ ft. high from the floor to the roof. Doors will open from either side of the car. Steps will also be placed at the ends, where they will connect with a running board at the foot of the car. A railing will extend down both sides. Eighteen of the cars will be built at once. The small cars will be used in drawing the boats under bridges in Cincinnati that are too low for the ordinary motor car. Each of the larger cars will weigh 30 tons. They will receive power from the Edison Lighting Company, of Cincinnati, and will be operated from 14 sub-stations scattered along the route and connected by telephone.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

The London County Council invites tenders up to October 8 for the supply of two 2,500 horse-power vertical steam engines, each direct connected to a continuous current 1,500 kilowatt generator working at from 550 to 625 volts. Three auxiliary vertical high speed, inclosed steam engines of 250 horse-power, each direct connected to a continuous current dynamo working at from 220 to 250 volts, are required. Specifications and further information can be obtained from the engineering department, London County Council, County Hall, Spring Gardens, London, S. W. A fee of $15 (returnable) is required. The contract will, it is believed, be worth over $200,000.

As an outcome of experience gained in the use of wireless telegraphy for military purposes in South Africa, Mr. Marconi has designed a portable outfit especially adapted to requirements in wartime, says the "Electrical Engineer," London. The inconvenience caused by the absence of the poles which are essential in his system led Mr. Marconi to devise a portable installation, and for some time past he has been experimenting with huge cylinders to act as receivers in lieu of the high wire. These cylinders are said to have proved to be more efficacious for the transmission of messages over short distances than the ordinary apparatus. When the electric currents are excited the waves at first oscillate very rapidly and violently, but in a few moments the vibrations die down, or become damped, in much the same way as the wire of a piano decreases its vibrations after a note has been struck. It is imperative that these vibrations should be sustained as much as possible, in order to travel over a long distance, and to ensure this end there must be a great capacity in the sending instruments. The effect of the cylinder is to render greater capacity than the ordinary aerial wire, and consequently more sustained vibration is obtained. The rear part of the automobile, which is of the Thornycroft steam motor type, is fitted up as an operating room, containing instruments and electric batteries. Upon the roof of the car the long cylinder is placed, and the arrangements are such that, when not required, the cylinder may be laid down flat upon the roof, out of the way. The cylinder is about 25 feet in height. It is constructed of metal and thoroughly insulated, and can be raised or lowered instantaneously. The car, owing to the strength of stability of its construction, is a typical vehicle for military work where rough roads are encountered, and makes a speed of from 12 to 14 miles an hour.

The Secretary of State has received a report from United States Consul General Stowe at Cape Town in regard to the growing interests of the United States in the trade of South Africa. "British trade is envious of the vast strides made during the last four years in the exploitation of manufactures and products of the United States," says Consul General Stowe, "particularly to British colonies and dependencies. A comparison of United States trade in South Africa with that of other countries is satisfactory, and appears more so when it is considered that our commerce with other countries, to which we have been selling for years, is less than with this country—a comparatively new one. Taking the imports from the United States at $20,086,128.36, it is shown that South Africa takes more of our products than does the Argentine Republic, Brazil, all the other South American States, the Chinese Empire, East Indies, Russia, Denmark, Spain, Sweden, Norway, Austria, Turkey, all the West Indies, not including Cuba, or all the Central American States, and this trade is only exceeded by that with the United Kingdom, Germany, Netherlands, France, Belgium, Italy, Mexico, Japan or British Australia. As to the future, it is said that plans are matured for expending $50,000,000 in new railways, that several thousand miles of telegraph lines are to be erected and renewed; that $500,000 is to be invested in electric lines in Natal, and we must not fail to bid for this work."

John J. Corish and Carl Scheid, of Newark, N. J., have invented a device for connecting trolley wires together when new lines are put up, or when breaks occur. The device consists of a cast brass sleeve, tapering both ways from the center like the rung of a ladder or a chair spindle. This is corrugated in the center to give a grip for pipe tongs, and is bored out from each end to within two inches of the center with a clearance for the trolley wire, while a smaller bore passes clear through and is tapped for two inches on either side of the center with a right-hand and left-hand thread, 16 threads to the inch. The ends of the trolley wire are held by a vise, or clamping device.

upon the scaffold wagon, and in two minutes are threaded with a stock and die. Two workmen can thread each end simultaneously, and inside of five minutes can screw on the sleeve and repair a break, which would require 20 to 35 minutes under the present method of riveting and soldering.

◆

IT is probable that the X-ray will be made use of in connection with President McKinley in an endeavor to locate the second bullet fired by the would-be assassin Czolgosz.

◆

ELECTRICIANS are at work wiring the immense dome of the Exposition Building at Milwaukee, Wis., which is to be used this year for a departure in the character of the show given by the exposition managers. Electricity will predominate throughout the exposition, but at the same time the industrial features will be retained. Incandescent lights will be placed upon the roof and dome so as to get an outline view of the building after dark. Thousands of lamps will be strung along the architectural lines of the dome down to the roof.

◆

DR. EIJI AOYAGI of the University of Kioto at Kioto, Japan, has been sent on a two years' trip by the Japanese Government to make an inspection of the leading electric plants of the world. He has been traveling in Europe for the past year and a half and arrived in this country a short time ago.

◆

A DISPATCH from Montreal, Can., states that American capitalists have undertaken to develop a vast wood pulp industry along the north shore of the Gulf of St. Lawrence. Messrs. Clarke Brothers of Toronto and New York recently purchased a timber limit of 500 square miles on the St. Marguerite River. They have just closed a deal with the Provincial Government whereby they purchased for $15,000 the water powers on the river seven miles from the village of Seven Islands. They propose to build a large pulp mill at Seven Islands, which will be operated by electricity transmitted from the falls. The mill will have a capacity of 150 tons of pulp a day and the company has signed a guarantee to expend $500,000 within two years from next spring, when work will begin. Altogether about $3,000,000 will be invested.

◆

A NOISELESS alarm clock would prove a boon to a host of sufferers from unseasonable din. The suggestion is made that a silent alarm can be given by focusing an electric lamp upon the head of the person to be awakened and arranging a switch so that the current to light the lamp would be turned on by the clock at the desired time. It is claimed that the flash of light would invariably arouse the sleeper.

◆

WITHIN a few months electric traction will replace horse power on the street railroads in Manila.

◆

ELECTRICAL apparatus used in mining in this country, is estimated to be worth $100,000,000.

◆

OSCAR GOODRICH, of Sioux City, Ia., has invented a bit of propelling mechanism that is calculated to revolutionize both the manufacture and the use of the automobile. So valuable is his device claimed to be that the Standard Oil Company has interested itself in it, and it is being fully protected by patents in both Europe and America. The new invention applies motive power directly to all four wheels, the front and rear wheels alike. Now power is applied to only two wheels, the rear two, and in consequence the driving force has been defective and troublesome, and there has not been the most complete possible utilization of the automobile's power.

◆

THE new Hungarian system of telegraphy, the introduction of which was announced eighteen months ago, was a marvelous success. The system has been installed between Budapest and Fiume, a distance of 375 miles, and is in practical working order at a speed of 40,000 words an hour. The messages are written in Roman characters and require no transcription. Negotiations are in progress for establishing the system in France and Germany. The latter Government will give it a trial between Berlin and Cologne and the installation will be completed in a short time. The system is an ingenious combination of the telegraph, the telephone and photography, the messages being written on sensitized paper by ray light and developed and fixed by an automatic process.

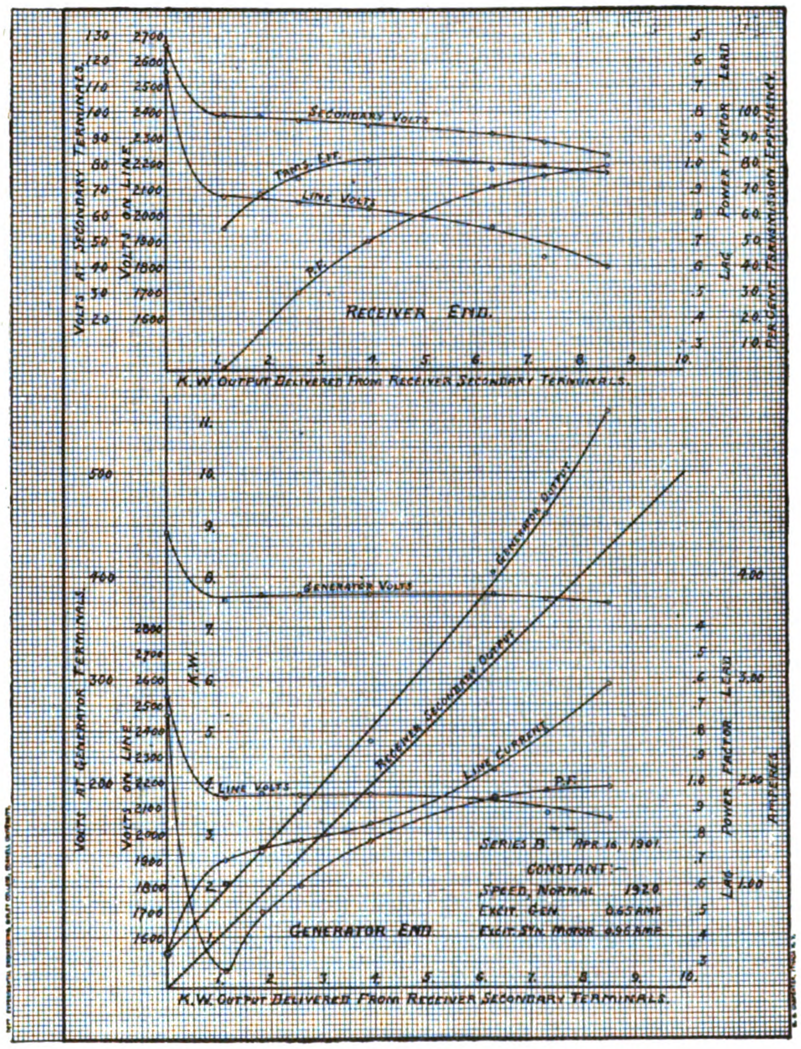

FIG. 6.

Performance of Transmission at Variable Load with Under-Excited Synchronous Motor.

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TORONTO, ONT., assessments on the street railway, telephone, gas and electric light companies have increased this year by $2,475,069.

◆

THE electrical motor business is increasing $150,000,000 a year in the United States.

PERFORMANCE OF AN ARTIFICIAL FORTY MILE TRANSMISSION LINE *

BY WILLIAM S. ALDRICH AND GEORGE W. REDFIELD.

(*Continued from page 135.*)

Power Factor at Generator End on Open Receiver Secondary.—When the receiver secondary circuit is open it will be noticed in all of the curves of performances that the power factor at the generator end is leading. The reason for this will be evident upon considering a series of readings by the two-wattmeter method, one or the other wattmeter always having the larger reading according to whether the resultant power factor of the three-phase line is leading or lagging. The current in the line under these given conditions is known to be leading because the charging current is in excess of the no-load current required by the transformers. Further evidence that the power factor at the generator end is leading is shown by the line voltage at the receiver end being higher than the line voltage at the generator end, and such a condition could not be possible, owing to the inductance of the line unless there was a leading current in the line. For no-load on the secondary, at the receiver end, similar conditions are obtained in all subsequent tests; hence, the resulting leading power factor of the three-phase transmission is the same in all cases of open receiver secondary.

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*Paper read at the 18th Annual Convention of the American Institute of Electrical Engineers, Buffalo, N. Y., August 21, 1901.

Description of the Synchronous Motor.—The transmitted power was absorbed at the receiver end by a machine made by the General Electric Company, constructed for single and polyphase work, as a generator; synchronous motor or converter. The armature has a distributed winding and was used as a three-phase machine.

DESCRIPTION OF SYNCHRONOUS MOTOR.

Type	Synchronous Machine
Capacity	7½ kw.
No. of poles	4.
R. P. M.	1,920.
Frequency	64 cycles
Normal voltage, three phase	110
Full load current per branch, three-phase	40 amp.

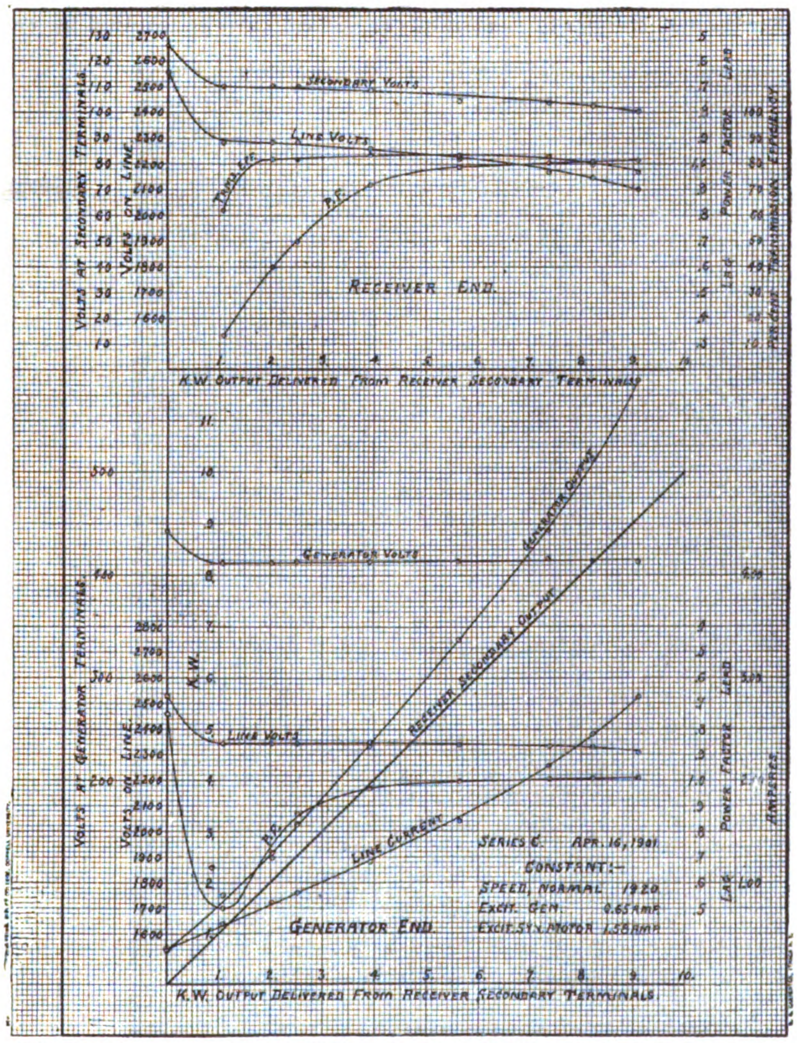

FIG. 7.
Performance with Normally-Excited Synchronous Motor.

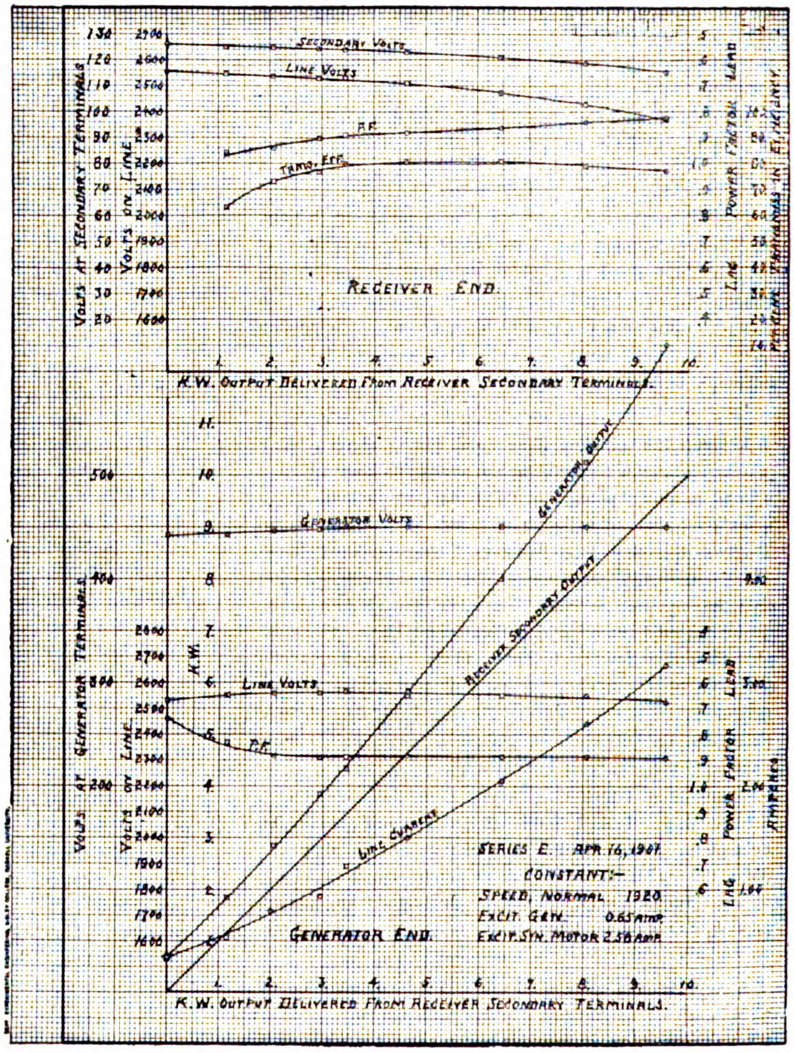

FIG. 8.
Performance with Over Excited Synchronous Motor Load.

Performance of Transmission at Variable Load with Under-Excited Synchronous Motor.—The curves of performance, Fig. 6, show that as soon as the synchronous motor is thrown on, as a lightly loaded receiver, at constant excitation of 0.96 amperes, taking about 1.1 kw., the phase displacement at the generator end immediately changes from lead to lag. The line current rises quite rapidly and the high-tension and low-tension pressures at each end drop considerably, due to the presence of lagging currents in the line and generator circuit. Under such conditions the regulation of the generator is greatly impaired, as shown in Fig. 4. The under-excited synchronous motor is similar in its effects upon the transmission system to an induction motor, producing lagging phase displacement materially affecting the regulation of the system. As the load increases, the line drop at receiver end falls off gradually, while the current comes rapidly into phase with the impressed EMF., reaching unity power factor at a trifle over full load. This effect partially compensates for the increased drop due to heavier loads and therefore has a tendency to keep the voltages up. The phase displacement at the receiver end controls the phase relations of these EMF.'s. The line current is exceptionally high under light loads, because under such conditions the receiver power factor is very low.

$$\text{Transmission efficiency} = \frac{\text{Output of receiver secondary}}{\text{Input from generator terminals.}}$$

The efficiency in this case reaches a maximum value of 82 per cent., at about half load, and has a maintained value of 80 per cent. and over from one-third to two-third load.

Performance with Normally Excited Synchronous Motor.—The characteristics under this condition are shown in Fig. 7. The constant excitation of the synchronous motor was 1.58 amperes, the excitation for its operating at practically unity power factor above half load. The resulting power factors are much improved at the generator and receiver ends under light loads. As the load increases, each of these power factors increase more rapidly than in the preceding case, and at full load they reach unity while beyond this point they are a trifle leading. The line drop is not so marked, resulting in better inherent regulation of the system.

The pressure at the generator end remains practically constant after the synchronous motor is thrown on the line. The line current rises gradually, improving the line efficiency by reducing the phase displacement, also improving the transformer efficiencies. Owing to this the transmission efficiency rises quickly and maintains a high value of 82 per cent., and over from one-fifth to full load. This bears out the earlier statements of this paper that best results are to be obtained in such a transmission system when the resulting phase displacement is a minimum.

PERFORMANCE WITH OVER EXCITED SYNCHRONOUS MOTOR LOAD.

The curves of performance under this condition are shown in Fig. 8. The constant excitation of the synchronous motor was 2.58 amperes. The pressure at the generator end does not drop at all when the over excited synchronous motor is thrown on, having a tendency to rise, due to the phase displacement of its external circuit remaining leading at all loads. This is equivalent, in its effects upon the generator, to over-compounding, producing the so-called "boosting" effect, as shown in Fig. 4, for an equivalent power factor of about 0.90 leading. The secondary pressure regulation at the receiver end is better than in any previous case, being exceptionally good, due to a leading phase displacement which increases with the heavier loads. This has a compensating effect upon the secondary receiver voltage which will be noted later.

The transmission efficiency is 80 per cent. and over from half to full load. In this case the efficiencies of the transformers are evidently reduced at their respective loads by the increased core losses under the higher impressed voltages. Their I²R losses are also increased for the same respective loads owing to the increasing phase displacement.

Constant Receiver Secondary Voltage and Variable Excitation of Synchronous Motor.—Fig. 9 illustrates the performance where a constant pressure of 120 volts was maintained at the receiver secondary terminals while the excitation was correspondingly increased with the load. There is increasing leading phase displacement after the small loads are passed. The transmission efficiency is at and above 80 per cent. from one-third to full load. Under similar conditions the receiver secondary voltage was maintained at 125, the no-load pressure, and the results are plotted in Fig. 10. The phase displacement at each end is decidedly leading. Therefore the line current is materially raised, increasing the I²R losses. Under this condition the transformers were operated at still higher pressures, correspondingly decreasing the efficiency of transmission.

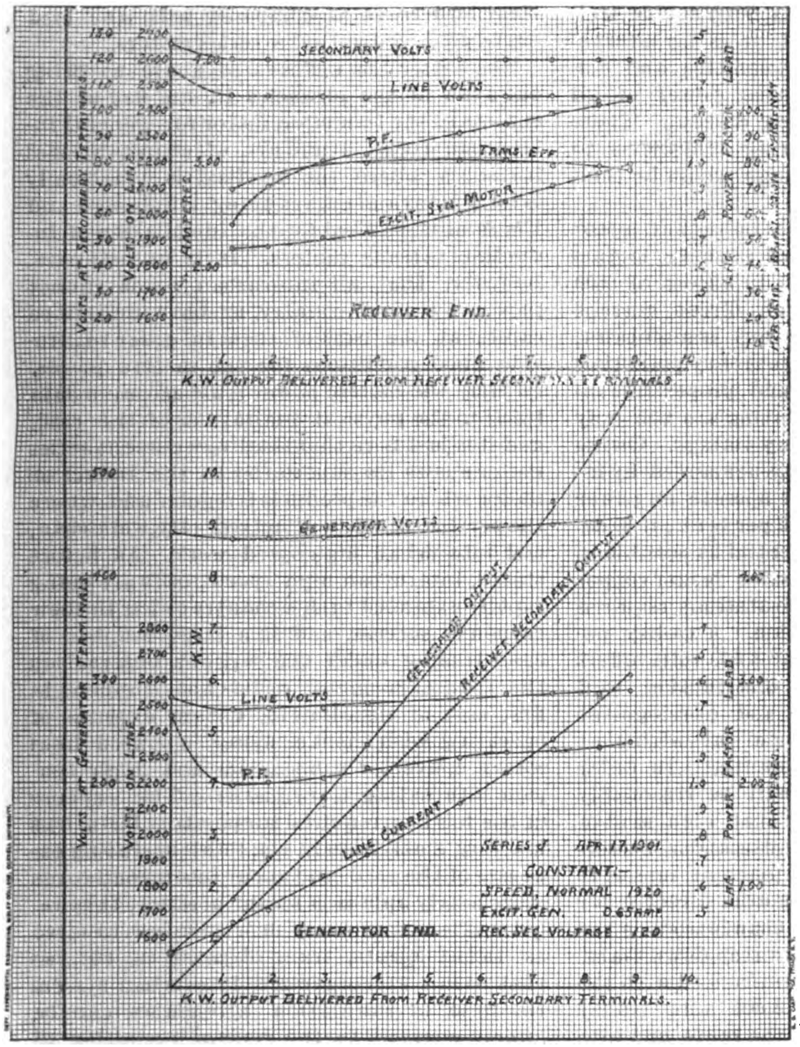

FIG. 9.

Performance with Constant Receiver Secondary Voltage, 120 Volts, and Variable Excitation of Synchronous Motor.

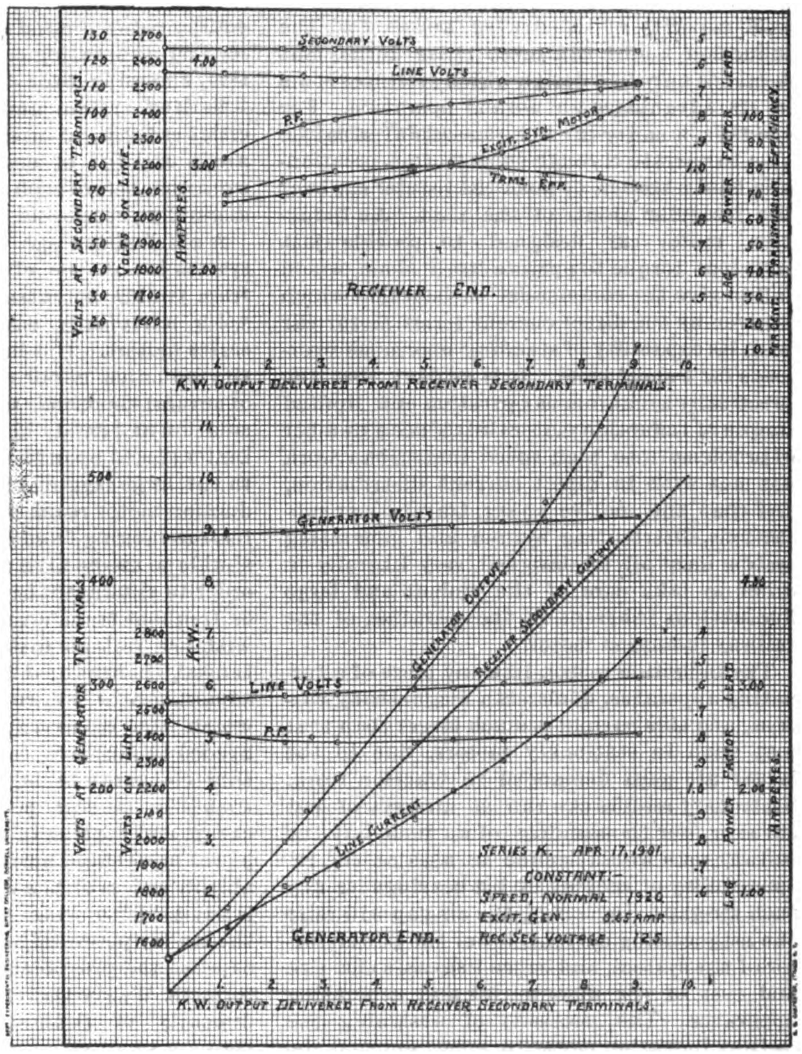

FIG. 10.

Performance with Constant Receiver Secondary Voltage, 125 Volts, and Variable Excitation of Synchronous Motor.

Effect on Generator Voltage by Increasing Synchronous Motor Excitation.—Under the leading phase displacement of the last two experiments the pressures at the generator show the characteristic increase noted in Fig. 4. The leading wattless components of current are comparatively large, and therefore have an appreciable influence upon the performance and regulation of the generator.

(To be continued).

NOTES ON MODERN ELECTRIC RAILWAY PRACTICE.*

BY ALBERT H. ARMSTRONG.

(Concluded from page 138.)

A principal advantage of the induction motor system lies in the reduction of the labor account due to the elimination of attendance at the sub-stations, the step-down transformers being self-cooled and requiring no more than casual inspection. Where the train service is infrequent and does not justify the expense of sub-station attendance every 12 or 15 miles, the induction motor system offers a substitute to the converter system worthy of very careful consideration. As the induction motor system introduces several features which are new, viewed from a direct current standpoint, a few of its characteristics will be touched upon.

The induction motor, while not a synchronous piece of apparatus, is such, so far as its behavior in railway work is concerned. A car equipped with such motors will run at practically constant speed up grade and down, or on level, thus making the car speed nearly independent of the profile of the road. The speed of the induction motor, depending upon the frequency of the source of supply, is not affected by the voltage, provided the voltage is sufficiently high to provide the torque required. This constant speed quality of the induction motor at first sight appears to be a desirable feature, as it would seem to insure the maintenance of a constant schedule speed not influenced by grades. The greatest objection, however, is that the practically constant speed of the induction motor car up the severest grades calls for a very large motor output and produces much more violent fluctuations upon the distributing and generating system than is the case with the d. c. series motor, which falls off considerably in speed on heavy grades. The system, being alternating throughout, provides no means of introducing storage batteries to smooth over these excessive fluctuations, and they are more liable to reach the generating station and produce an irregular load curve with its greater coal consumption than is the case with direct current series motors and rotary converter sub stations, even though this may be used without storage battery auxiliaries. Where the system is so extensive that each individual car or train is a small increment of the total load, this objection of fluctuations upon the generating station will of course not hold true. The motive power, however, must provide for the running of the car or train up the steepest grade at practically the same speed at which the car operates upon a level, and the motors must therefore be designed to stand a greater output for the same service performed than the direct current motor.

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*Paper read at the 18th Annual Convention of the American Institute of Electrical Engineers, Buffalo, N. Y., August 2, 1901.

The induction motor can give only a certain maximum torque with a given impressed line voltage, and as this torque decreases with the square of the impressed voltage, it will be necessary to carefully determine the operating conditions of the motor and of the distributing system in order that the motor may be able to start its car or train upon the heaviest grade with the minimum line potential met with in operation. The direct current series motor can give a torque much in excess of any service demand, without sacrificing its running qualities at light loads. Railway service calls for a large overload capacity of its motive power, and the induction motor can meet these infrequent demands only by a design which sacrifices some of its advantages for normal operation. For example, a motor car to be successful must be able to operate through snow storms, occasionally haul a trailer, or push the regular car over the irregular profile of the road. An induction motor car designed to provide just sufficient torque to operate itself alone, would fail to give the commercial satisfaction which is given by the direct current series motor car with its capability of standing enormous overloads for a short time. It is evident that the practically synchronous operation and limited torque of induction motors introduce a number of problems into high speed interurban work not met with in direct current distribution, and that the motive power, transformer substations, distributing system and generating system must all be designed very liberally in order to take care of the violent and large fluctuations inherent in the operation of the railway induction motor.

The induction motor, like any piece of alternating apparatus, demands a magnetizing current, and this current is much larger than that met with in stationary motors, due to the larger air gaps demanded in traction work. Stationary motors can run at air-gaps of but three or four thousandths of an inch, but the railway man would decline to assume the responsibility of keeping up his bearings for any such air-gap. Increasing the air-gap will raise the magnetising current, lower the power factor of the system, and hence increases the size and cost of the distributing and generating apparatus. The necessity of designing the railway induction motor to meet unusual demands occurring very unfrequently further increases this magnetizing current, due to the high density required in the iron circuit with a reasonable motor weight. Even with a liberal air gap, viewed from an induction motor standpoint, such a motor demands a clearance between field and armature nearly 50 per cent. less than is common practice with d. c. motors. The maintenance of linings with a small gap is a matter for consideration, particularly when it is remembered that when the armature of an induction motor strikes its field, it may destroy two sets of windings as the field is a duplication of the armature winding. We are therefore confronted with the maintenance of an air-gap of half the width and double the expense of repair with the induction motor to offset the small commutator maintenance of the direct current motor. The installation of high-speed interurban roads in this country has been brought about by the financial success of the earlier roads of this character. Because a system is operative is no reason for its adoption unless there is sufficient promise of its superiority over present methods. Our interurban and suburban roads possess a very strong advantage in being able to traverse city streets en route and at their termini. All the large cities in this country, and most of the smaller ones. have direct current railway systems in operation, and the direct current interurban and suburban system can therefore run its cars over existing city systems without in any way conflicting with the operation of such roads. The induction motor interurban system, on the other hand, would necessitate the changing of cars at the outskirts of the termini cities, running around the cities passed en route, or else the equipment of unused streets with double trolley and alternating current; or as an alternative, changing over the generating and distributing system and motive power of all cities entered, to alternating current. There are a number of engineering difficulties to overcome before such a change would be commercially practicable.

A chief advantage of the induction motor system lies in the ability of running motors from trolley potentials far in excess of 600 volts universally used with direct current series motors. Not having any commutator, the induction motor can use trolley potentials of several thousand volts, and proper line insulation and safety in operating are the only limits placed upon the trolley voltage. Owing to the large lagging currents demanded by induction motor roads which operate at power factors ranging from 50 to75 per cent., it is desirable to use as high a potential as possible in order to eliminate the excessive feeder copper or frequent transformer sub-stations required with low voltage distribution. A trolley potential, therefore, of 2,000 or 3,000 volts offers advantages in interurban distribution well worth the extra expense and development needed to insulate trolley and car wiring at this comparative high potential. In order that the motive power will be reasonably cheap, and bearing in mind that such motive power must stand maximum demands considerably in excess of the direct current motor, it is advisable to wind the motors directly for the trolley potential rather than introduce the expense and provide space for step down transformers. We are therefore confronted with the difficulty of running a 3,000 volt trolley through small cities along the route and into large cities at the termini, even assuming that the cost of changing over such systems to alternating current would be justified.

Step-down transformers installed upon the car, reducing from 3.000 to 600 volts, open the possibility of running motors without step-down transformers on city streets, and with step-down transformers when the trolley potential is 3.000 volts in the open country. The double trolley, however, complicates the city system and adds additional expense to the already expensive motor equipment. The induction motor, moreover, is not adapted to city street running, calling as it does for constant acceleration and efficient operation at fractional speeds. Instead of efficiencies of acceleration in the seventies obtained with direct-current motors, the induction motor would give an efficiency of only 40 to 45 per cent. during acceleration with a corresponding increase in coal consumption, making it compare very unfavorably with the direct current motor for city work. The adoption of the induction motor for interurban work seems limited, therefore, to those roads running on private right of way throughout, and having no connection with existing city systems at their termini or en route. Even in this class of roads, if the service is at all frequent and profile very irregular, the direct converter system with its third rail distribution may prove cheaper to install and operate. The reduction in operating expenses which the induction motor effects by dispensing with rotary converter sub-station attendants may be more than offset by introducing apparatus whose volt-ampere capacity may be double the kw. capacity required, and which furthermore may operate with a very irregular and inefficient load curve as compared with the load curve produced with d.c. series motors.

The writer has endeavored above to bring out a few of the obstacles in the way of the success of the induction motor for general interurban work. There are, of course, special instances where the roadbed is practically level, grades and curves being eliminated and the conditions ideal for the installation of induction railway motors. It is unfortunate, however, that all interurban roads cannot pick out a level country, or have unlimited capital at the back of them in order to provide ideal conditions for the motive power. In fact, the motive power must accommodate itself to the physical limitations of the road, and it is just here that the direct current series motor shows its superiority to the induction motor where the profile is irregular and where the service consists of mixed city, suburban, and interurban high-speed work. As before stated, interurban high speed roads are being rapidly extended in this country owing to their economic success, and in a large number of cases coming under the writer's observation the induction motor could not compete in first cost of installation, nor in expense of operating with the d.c. motor, operated from rotary converter sub-stations and high tension alternating transmission. The expense of the few men required to operate sub stations is a very small item in the total operating expenses of the road, and as our interurban roads more nearly approach steam practice, they require attendants every 10 or 15 miles to serve as ticket agents, train dispatchers, etc., so that with a well organized interurban system the item of sub station attendance can be largely charged to the general operation of the road and not to the cost of producing power.

The ideal conditions for the operation of induction railway motors seems to be a regular profile, either level or a uniform up grade, private right of way with no city or suburban running, infrequent service, and freedom from unexpected and fluctuating demands upon the motive power. Electric railway work up to the present has demanded considerable of the motive power in the way of meeting large momentary overloads, running at different speed, line voltage, etc , and the direct current series motor has shown itself well equipped to meet these requirements. The induction motor is more adapted for operation under predetermined conditions, and its design does not lend itself to the same broad field of usefulness now covered by the direct current series motor.

In a service calling for frequent stopping where the demand upon the motors is largely acceleration work, the induction motor must dissipate considerably more energy for the same service performed than the direct current motor, and hence must be correspondingly heavier and more expensive. For constant speed running the induction motor, however, must dissipate but little more energy than the d.c. motor, and from the nature of its design may dissipate that energy more rapidly.

This brings up a new class of railroad work just being considered, and that is mountain railroading and long-distance cross-country roads for either high speed passenger or freight work. The conditions governing both these classes of work are practically the same in that they demand a constant sustained output of the motive power, and it is in this class of work that the induction motor is being seriously considered.

Direct current motors fed from a system of rotary converters connected to a high potential transmission distribution system are open to the objection that a trolley or third rail potential under 1,000 volts must be used, necessitating the collection of very large currents and an undesirable frequency of converter stations, or prohibitive expense of third rail and feeder construction. The power consumed by a freight train of 2,000 tons or more may reach 3,000 hp. on the grades encountered in steam railway mountain work, and the ability of the induction motor to collect this large amount of energy at a trolley potential of 3,000 volts or more, gives it a distinctive advantage in first cost of installation and expense of operation compared to direct current distribution. High potential alternating trolley systems present certain difficulties in the way of insulation, but after several years' experience with high potential transmission lines, these difficulties should be easily surmounted. Such systems also employ locomotives and not individual motor cars, so that the high potential apparatus is localized, and more space is provided to properly insulate all high-tension wiring.

The operation of heavy freight trains, or high speed passenger trains on trunk lines is the work of the future, and will be undertaken as soon as it is evident that a saving will result in operating expenses by the substitution of electricity for the steam locomotive. Trunk lines having local passenger traffic could very well equip their tracks with both high potential overhead trolley for the operation of heavy through trains and freight work, and also use a third rail construction to operate direct current 600-volt d.c. motors for the short haul work. Both these systems could be fed from the same generator and transmission lines, operating 25-cycle rotary converters to feed the third rail system at intervals, and step down transformers to reduce the potential to the 3,000 volts or more required for the overhead high-tension trolley line. This mixed system provides for the maintenance of a steady load on the generating station, while it permits the local and short haul traffic to benefit from the advantages of the d.c. motor for this class of work.

The electrical equipping of trunk line steam roads is a very large engineering proposition, involving such radical changes in the operation of such roads that its commercial success must be undoubted before the work is undertaken. It is possible that such a movement will be brought about by the equipping of some of the new high-speed third rail interurban systems with overhead trolley operating at 3,000 volts alternating current. These systems are rapidly being extended and interconnected, and will soon be able to take care of long distance work when the systems are sufficiently joined together. The management of such roads, owing to their experience with electric traction, may be reasonably supposed to be more open to the advantages of electric haulage, while the establishment of a line of generating stations, all operating at the standard frequency of 25 cycles, will offer the means of feeding such a system with a comparatively small cost for equipping. The various sub-stations, however, and the d.c. copper distribution are not adapted to the operation of large heavy units, although the transmission lines and generating stations could well feed these trains with a reasonable outlay for high-tension overhead trolley construction.

It is along such lines that the writer looks for the introduction of the induction motor as a railway factor in this country, and there are several propositions in view where the introduction of the induction motor seems justified and preferable to the steam locomotive now in operation.

AN ASYNCHRONOUS INDUCTION MOTOR OR GENERATOR WITH A POWER-FACTOR OF UNITY.[*]

BY ALEXANDER HEYLAND.

The following article describes a method of producing the interesting and desirable result of eliminating the well-known phase difference between current and pressure in asynchronous induction motors, and thus at the same time doing away with the wattless magnetizing and light load currents, and the consequences of the air-gap between the stator and rotor of these motors. This is attained by producing the rotatory field, not by the primary armature, but directly in the secondary armature,[†] by means of a simple arrangement which can be fitted to any type of motor without great difficulty.

The principle employed is as follows:—Let Fig. 1 represent a three-phase induction motor with a simple short-circuited armature—a so-called squirrel-cage armature. Let A be the stator or primary armature of the motor, and B the rotor or secondary short-circuited armature with copper bars distributed in holes or slots around the circumference, these bars being short-circuited at each end of the armature by a ring, K. Then, as is well known, a three-phase alternating current generates a rotatory field in the stator A, which traverses equally both armatures (the stator A and the rotor B), and sets up a turning moment between the stator winding and the closed armature winding of the rotor.

The field is generated in the stator, in distinction to that in the synchronous motor which would be obtained in this instance, for example, if the short-circuited armature were replaced by a magnet wheel. The exciting currents of the stator which generate the field are alternating currents of the full frequency, and therefore do not correspond, as in the case of continuous currents or alternating currents of lower frequency, to the necessary field excitation, but are considerably greater. As is well known, in circuits with high frequency a so-called counter EMF. of considerable magnitude is produced, and the magnetizing current is produced by the small remainder after subtracting this counter EMF. from the pressure at the terminals. Owing to this, these currents differ considerably in phase from the pressure. On the other hand, the energy of these currents actually converted into heat in the copper is very small. As a rule it is considerably less than 1 per cent. of its apparent value.

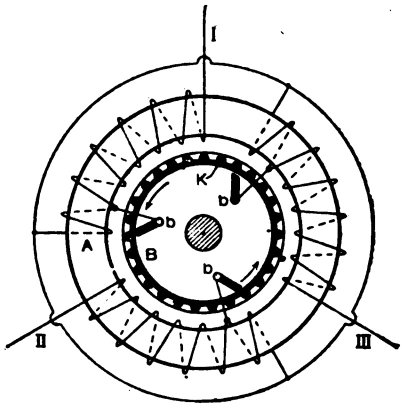

Fig. 1.

All this is prevented if we produce the rotatory field, not in the stator, but directly in the short-circuited armature. In the short-circuited secondary armature—i.e., the rotor B—the back EMF. does not exist, or, if it does, only in a quite subordinate degree. The frequency of the variation in the field is here only very small, and is given directly by the slip of the motor. As is known, the armature rotates with the rotatory field. Its velocity with regard to this field differs only to a small extent (the slip), which just suffices to induce in the armature the current necessary for turning it. In distinction to the high EMF. of the stator, the EMF. of the rotor is, consequently, very small, and is only what is required to induce short-circuit currents which occasion the ohmic losses in the copper converted into heat. Now, if we send through the secondary armature, instead of through the primary armature, the magnetizing currents necessary to produce the rotatory field common to both we avoid the troublesome counter EMF.'s which are set up in the stator. The whole pressure necessary for the magnetizing currents drops to the small value which is necessary to cover the ohmic losses in the copper. The only problem before us is to convey the currents into the winding of the rotor, which is closed in itself, and to convey them in such a way that they have exactly the same direction and phase as the magnetizing currents of the stator which they are to compensate.

The simplest way to do this, as shown diagrammatically in the figure, by three brushes *bbb*, which are in contact with the end of the ring K of the armature, and whose position with regard to the stator is so adjusted that the currents led to the armature have exactly the same direction as the magnetizing currents of the stator had. The pressure of these currents need only be very small (even if one asssumes approximately the same number of turns on the stator and rotor) and they can be taken from a few turns of the stator.

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[*] From the "Elektrotechnische Zeitschrift," August 8. Translated for the "Electrician," London.

[†] An endeavor to compensate the difference of phase has already been made by Leblanc. For this he uses an auxiliary motor which he switches into the circuit of the short-circuited armature. By adding such an auxiliary motor, however, the arrangements are very much complicated.

Thus a conversion of the current takes place from high frequency (primary armature) into low frequency (secondary armature), and yet we have not employed for this a commutator in the ordinary sense of the term, but have accomplished the conversion, as is seen in the diagram, by a continuous ring. In general one would not use the so-called squirrel cage armature, for the currents under the brushes would be too great. One can, for example, close a wound armature by a ring whose resistance bears a certain relation to the resistance of the winding. This has not any great effect on the efficiency. In the first place, the losses in this ring need only be small, and in the second place, one can reduce the losses in the winding by making the slots deeper and putting some more copper on the armature. The increase in the magnetic leakage thus caused is not important, as the phase difference is already avoided by the arrangement described. Besides, this is not necessary, as the following example will show.

The most remarkable thing about the motor is the commutation of the current by a commutator formed of a ring closed on itself. It is natural that such a commutator is not at all complicated, and works as simply and sparklessly as the usual slip rings on induction motors. A pertinent objection is that a part of the exciting current must be lost in the shunt which the ring forms to the winding. This is correct, but by the arrangement described the exciting current is already so reduced that this loss is without importance.

Assume that the copper loss in such an armature is 3 per cent.—2 per cent. in the winding and 1 per cent. in the ring, the resistance of the ring being thus half that of the winding. Let the magnetizing current be one-third of the total current, the magnetizing loss thus one-ninth of the total copper loss, i.e., two-ninths per cent. loss in the winding. To this must be added another four-ninths per cent. lost in the shunt formed by the ring. Thus, altogether we have six-ninths equals two-thirds per cent. magnetizing loss, and so, in spite of the shunt and the loss due to current in the ring, this is so little as to be unimportant.

One may find a certain analogy in continuous-current work in the replacement of copper brushes by carbon brushes. There, too, owing to the larger contact resistance at the brushes, the losses at one place are artificially increased, as a rule, to a much greater extent than here. Nevertheless, one accepts them willingly as they are well compensated by other advantages.

In the practical application of this system, it is advisable to employ a commutator instead of a single ring of resistance material, the sections of the commutator being connected together by electrical conductors of small resistance. In principle this changes nothing, of course, and in this case also the shunt prevents sparking at the brushes.

Finally, one can also employ at the same time a short-circuit winding and a second exciting winding with a commutator. The self-induction of the commutator winding will then be removed by the short-circuited winding, and there would again be no sparking at the brushes. In the case of motors with wound rotors and slip rings for starting, the exciting ring is best placed at the neutral point of the three armature phases.

The following then takes place in actual working:—The momentary position and synchronous rotation on the field with regard to the exciting armature is fixed by the position of the brushes (Fig. 1), and is independent of the speed of the armature. The current led through the brushes produces in the short-circuited armature a field rotating with the latter. If the armature is running synchronously at no load, the field in the armature is constant and the current is quite unchanged in direction and is a continuous current. When the armature is loaded, the reaction of the exciting armature will slowly rotate the field in the short circuit armature, there is a slip, and working currents are thus induced in the closed winding of the short-circuit armature which tend to stop the field from rotating. Then the currents led in through the brushes constantly reproduce the field in each position, and the working currents induced by the slip tend with a certain force to retain the field in its momentary position and transmit the work or the turning moment from the exciting armature to the short-circuited armature. The same working or useful currents flow through the primary armature in an opposite direction to those in the short-circuited armatures, but no magnetizing current flows.

In order to eliminate the phase-shifting entirely, the current passing to the brushes must, of course, be regulated. This is done by adjustable resistances placed in the leads. One can then go further, and finally, by over-excitation, produce a lead in the phase as with synchronous motors.

The advantages of compensating the phase lag in a motor need hardly be mentioned. The shifting of the phase is well known as one detriment to the three-phase motor which is so excellent in every other respect. It prevents, as a rule, the direct connection of the motors to low-pressure lighting networks. In pure power-transmission it has the effect that, except at full load, the wattless currents are often greater than the actual useful currents. Even with an average power factor of $\cos \varphi = 0.7$, the wattless currents which are equal to $\sin \varphi$ will be actually as great as the useful currents. Even with a fully-loaded motor, whose $\cos \varphi$ may be 0.9, the wattless currents are half the useful current. In addition, it must be remembered that even this result is arrived at only with the help of what is recognized as the minimum air-gap that can be employed, while for mechanical reasons and security in working it would be preferable to employ larger air gaps between stator and rotor, as, for instance, in the continuous-current motor.

Further, the motor can run as a generator, and deliver current independently of other machines. It is self-exciting, just as a continuous-current dynamo, and there is no need of any exciter. The frequency is not, as in ordinary alternators, absolutely fixed by the speed, but it is somewhat less in relation to the speed of the rotor, according to the load. Its speed and frequency are asynchronous, the opposite case to that of ordinary alternating-current machines, and it can be connected in parallel with other generators without being previously brought up to synchronism. Switching in parallel and parallel running of such generators are just as simple as with continuous-current machines, and all the various difficulties known in connection with the parallel running of alternating-current machines, due to uneven turning moment of the engine, are eliminated. The system is therefore particularly suitable for the construction of large slow-speed machines, directly coupled to steam engines, the uneven turning moment of which throws great difficulties in the way of parallel running, and necessitates heavy flywheels.

It may be expected that the trials of the system will bring out further results. Probably it will be possible by a similar arrangement to compound this generator for constant pressure at variable loads as a compound continuous current machine, and finally to make it compensate phase lag in the network.

UTILIZING THE SUN'S ENERGY.*

Prof. Thurston discourses in "Cassier's Magazine," for August, upon the problem of utilizing the sun's energy. He points out that in spite of the enormous deposits of coal remaining untouched in other sections of the globe, within a few generations at most, some other energy than that of combustion of fossil fuel must be relied upon to do the work of the civilized world.

He considers that water power, which is the next most important source of energy to coal. will do much for us, and quotes figures which go to show that the energy capable of use in the area drained by the Mississippi River, for instance, may be taken at about a quarter of a million horse-power per square mile. In the next few lines, however, Prof. Thurston points out that such figures are of little value, and this is certainly correct. It is obvious that the available water power must be calculated from the minimum volume falling under easily utilizable heads. A fall of 6 inches per mile, as in the case of the Mississippi (with the exception of the three small water falls), is of no use whatever.

Prof. Thurston disposes of wind-power and tidal-power after very few remarks, and devotes himself principally to the consideration of the possibility of converting the heat of the sun into mechanical energy by some direct means.

He refers to John Ericsson's contributions to the Centenary Exhibition in 1876, and the figures quoted are certainly interesting. It would appear that with Mr. Ericsson's concentration apparatus, during nine hours per day, an average of fully 3.5 units of heat per minute can be extracted for each square foot of area presented perpendicularly to the sun's rays in all latitudes between the equator and 45° of latitude. Theoretically, this works out to 8.2 hp. for an area of 100 feet. It appears that there is a rainless region extending from the northwest coast of Africa to Mongolia, 9,000 miles in length, and nearly 1,000 miles wide. Besides the North African deserts, this region includes the southern coast of the Mediterranean, east of the Gulf of Cabes, Upper Egypt, eastern and part of the western coast of the Red Sea, part of Syria, the eastern part of the countries watered by the Euphrates and Tigris, Eastern Arabia, the greater part of Persia, the extreme western part of China, and lastly, Mongolia.

In the western hemisphere, Lower California, the tableland of Mexico and Guatemala, and the west coast of South America, suffer from continuous intense radiant heat for a distance of more than 2,000 miles.

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*From the "Electrical Review," London.

Calculations based upon the assumption that 1 hp. could be developed for every 100 square feet exposed to solar radiation would lead one to enormous figures if applied to the area above mentioned. For the purpose of example, however, Mr. Ericsson takes a strip of land a single mile in width, along the rainless western coast of America, the southern coast of the Mediterranean, both sides of the alluvial plan of the Nile in Upper Egypt, both sides of the Euphrates and Tigris for a distance of 400 miles above the Persian Gulf, and finally a strip also a mile wide along the rainless portions of the Red Sea above alluded to. The aggregate length of these strips of land, selected on account of their being accessible by water, far exceeds 8,000 miles. The area covered would be about 223,000,000,000 square feet, and on the assumption that 100 square feet could produce 1 hp. during an average of nine hours per day, we are led to the conclusion that by suitable apparatus 22,300,000 engines each of 100 hp. could be kept working by utilizing only that heat which is now wasted on the assumed small fraction of similar land extending along some of the water fronts of the sunburnt regions of the earth.

These figures are certainly interesting, and it would appear from results of other experimenters that Mr. Ericsson's assumption of 1 hp. from 100 square feet of receiving area is quite within the bounds of practical possibility. In fact, according to Prof. Thurston, this figure has been confirmed by recent experiments at Pasadena, in California, where it was stated that Ericsson's efficiency has in some cases been attained. The apparatus used in California was a truncated conical mirror, 33 feet 6 inches in diameter at the top and 15 feet at the bottom, which concentrates the rays of the sun received upon its 1,788 facets at a focus, where a boiler is placed and steam generated to work a steam engine. The whole mass is moved by clockwork and automatically held with its axis directed toward the sun. The boiler, which is carried on the same frame and moves with the mirror, is 13 feet 6 inches in length, and contains about 10 cubic feet of water and 8 cubic feet of steam space, pressure being maintained at 150 pounds per square inch. The apparatus is said to be of 10 hp., but Prof. Thurston remarks that the reported figures are inconsistent with this rating. It is unfortunate that Prof. Thurston does not quote these figures, which would certainly be of great interest.

It is not often that nature makes things easy for us. As a rule, the really useful large water-powers are also located in places remote from any form of civilization, thus severely handicapping the efforts of engineers to utilize the energy of falling water, and to turn it to useful account.

Meeting of the International Association of Municipal Electricians.

The Sixth Annual Meeting of the International Association of Municipal Electricians opened in the convention hall of the International Hotel, Niagara Falls, at 2 P.M. September 2. Mr. Morris W. Mead, of Pittsburg, Pa., presided.

The Rev. A. S. Bacon, pastor of the First Presbyterian Church, offered the opening prayer, following which Mayor M. B. Butler, of Niagara Falls, delivered the address of welcome. He referred to the great power development and how closely allied to it were the members of the association in the application to general utility. Mayor Butler's remarks explained clearly many interesting features of the power development, and he told how Niagara would have 200,000 developed horse-power. He welcomed the delegation and gave them the freedom of the city.

Capt. William Brophy, of Boston, responded to the Mayor's address in behalf of the association.

President Mead referred to the excellent work of M. J. Donohue, chairman of the executive committee, and Mr. Donohue, who is city electrician of Niagara Falls, was called before the convention. He made a brief speech.

The address of President Mead was then delivered. Its import was the effect that the members were there for business. When President Mead finished, Frank C. Mason, of Brooklyn, stepped to the front and, on behalf of the association, presented Mrs. Mead a solitaire diamond ring and Morris Mead, Jr., a Niagara souvenir spoon. Three cheers were given for Master Mead and he was made an adopted son of the association.

Various letters and invitations were received and then W. M. Petty, superintendent of telegraph of the Rutherford (N. J.) Fire Department, read a paper on "The Protection of Fire and Police Telegraph Wires from High Tension Currents and Lightning." The paper was eagerly discussed, and the opinion of Mr. Brophy, of Boston, was that the manufacturers of fire alarm boxes were not keeping up with the progress in other electrical lines.

On Tuesday, September 3, the meeting was called to order by President Mead at 10 o'clock. An address was delivered by Mr. H. W. Pope on "Telephones as Applied to Municipal Affairs." A paper was also presented by Mr. E. F. Schurig, of Omaha, entitled "Municipal Control vs. Municipal Ownership."

At the Wednesday morning session a paper was read by Mr. P. H. Alexander, of New York, on "Magnetic Car Brakes."

A committee of five was appointed to examine the magnet to the fire alarm telegraph system and report at the next convention.

A vote of thanks was extended by the delegates to Mrs. Ada Green for the excellent manner in which she had looked after the ladies of the convention.

The secretary's report showed a membership of 118 when the convention came to Niagara, but many new members had been elected, making the total membership over 130. The treasurer's report showed receipts of \$475 during the year, with expenses of \$540.45. As the balance in Pittsburg was \$381.05, the association has a balance on hand to-day of \$315.50.

New officers were elected as follows: President, A. S. Hatch, Detroit; vice-presidents, W. M. Petty, Rutherford, N. J.; A. G. Ferrand, Atlantic City; William Crane, Erie, Pa.; W. A. Barnes, Bridgeport, Conn.; secretary, F. P. Foster, Corning, N. Y.; treasurer, Adam Bosch, Newark, N. J.

Executive Committee—W. H. Thompson, chairman, Richmond, Va.; M. W. Mead, Pittsburg; William Brophy, Boston; J. W. Aydon, Wilmington, Del.; F. G. Boyd, Baltimore, Md.; F. C. Mason, Brooklyn; W. Y. Ellett, Elmira; G. F. MacDonald, Ottawa; M. G. Campbell, Grand Rapids, Mich.

Finance Committee—M. J. Donohue, Niagara Falls, chairman; J. F. Zeluff, Paterson, N.J.; Jerry Murphy, Cleveland; Elmer Loomis, Allegheny; Ion Simon, Jr., Charleston, S. C.

Richmond, Va., was selected as the place of the next annual meeting.

NICOLA TESLA.

(By George V. Hobart in the New York "Morning Journal," "Dinkelspiel's Lives of Famous Men.")

Led us now short-circuit ourselfes vile ve grab a few volts from der life uf Nicola Tesla, vich he is der mosd vunderful inwentioner dot efer received a shock from seeing his name in der papers.

Nicola took his fairst name from der machine vare you drob a nickle in der slot, bud uddervise his inwentions haf been orichinal mit himself.

During der briefest part uf his age Nicola inwentioned a vay to took milk from a boddle by electricsissity, bud id nefer became popular.

Two veeks later Nicola took a goot long smoke, vich resulted in communication mit der planet Mars.

Der name uf der town in Mars vich Nicola reached mit his electric current vas Pipesburg.

Id vas der postmaster dot answered der tellyfone.

"Hello Mars!" set Nicola.

"Vot dit you vish?" set der postmaster uf Pipesburg.

"Is dis Mars?" set Nicola.

"Id is, und Chon Doe is nod ub here," set der postmaster.

"I haf a feeling dot my conversationing mit you vill ged in der newspapers," set Nicola; "haf you anyding to communication vich vill look vell near my picture?"

Den der postmaster in Pipesburg ub in Mars reached ofer der vire und handed dis message to Nicola:

In Mars dare vas no pool rooms yet;
Ve do nod gamble here, you bet!
Doan'd show us how to make dem tips;
Und blease keep silence mit dem chips!——
Ring Off!

In Mars ve nefer haf der Trust,
Und bubbling banks doan'd nefer bust;
Each man ub here has plendy dough—
Doan'd tell Chay Pierpont Morgan, though!——
Ring Off!

GESUNDHEIT!

In Mars ve lead a quiet life,
Dewoid of bidderness und strife,
So doan'd suchchest no udder style—
Ve vould be habby yet a vile!——
Ring Off!

In Mars all strikes ve arbitrate:
All our policemens dey vas straight;
Ve do not vish der udder style,
Led us be habby yed a vile——
Ring Off!

In Mars der street cars vas so vide
Dot eferyvun sids down to ride;
So doan'd suchchest dot udder style
Vare foolishers fill ub der aisle——
Ring Off!

Mit a haughty chesture uf impatiency Nicola hung up der receifer on der tellyfone and refusaled to sbeak any more mit Mars.

Any stranger dot vould send such poeticals ofer der vire deserfs much animosity, anyvay.

Nicola den valked ouid und inwentioned dese articles:

A electrical derrick to helb Sir Tummas Lipton lift der cub.

A electrical street car vare der aisles rise ub und slap anyvun dot doan'd vait for der next car vich ain'd so crowded.

A electrical tipper for pool rooms vich can be used as a folding bed ven dare is no raid.

A electrical indictment for der police vich can be used as a tooth brush ven dare is no evidence to conwiction dem.

A electrical machine to purify politics vich can be used as a lawn mower der nexd day because politics refusaled to be purified.

Nicola also inwentioned a electrical sunset to took der place uf der vun ve are using now, vich is old und ouid uf date.

From der life uf Nicola ve learn der lesson dot der Sunday newspapers vas der mother uf many inwentions vich aftervards become orphans.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended September 4:

Alexandria, 1 package, $40; Antwerp, 41 packages, $4,043; Argentine Republic, 208 cases, $19,593; Australia, 175 cases. $25,205; 1 reel cable, $368; Berlin, 6 cases, $294; Brazil, 25 packages, $1,700; Bremen, 8 packages, $140; British Possessions in Africa, 85 cases, $4,117; British East Indies, 21 packages, $449; British Guiana, 8 cases, $75; British West Indies, 3 cases, $1,700; Cardiff, 1 case, $135; Central America, 21 cases, $858; China, 9 cases, $290; Chili, 7 cases, $153; Copenhagen, 2 coils cable, $1,123; Cuba, 90 packages, $3,452; Genoa, 22 cases, $3,000; Glasgow, 425 cases, $52,469; Hamburg, 34 cases, $1,801; Havre, 28 packages, $1,598; Hayti, 1 case, $56; Hong Kong, 28 cases, $728; Japan, 49 packages, $12,712; Leeds, 3 packages, $267; Liverpool, 110 packages, $5,669; London, 176 packages, $8,252; Mexico, 91 package, $3,138; Newcastle, 3 cases, $582; Newfoundland, 24 cases, $565; Nova Scotia, 1 package, $40; Philippines, 51 cases, $528; Rotterdam, 2 cases, $100; Santander, 3 cases, $258; Siam, 2 cases, $208; U. S. Colombia, 11 cases, $380; Venezuela, 374 cases, $1,695; Vladivostock, 10 cases, $2,355.

Proposals Invited.

Sealed proposals for furnishing and delivering the necessary materials and labor required to construct an extension to the electric light system at the Indian School at Chemawa, Ore., will be received until September 23, 1901. Intending bidders can obtain all necessary information by addressing Superintendent Thos W. Potter at the school.

A Position Open.

The manager of an electric light company in Montana writes to ELECTRICITY as follows: "We have a position open, with steady employment to the right man; wages $85 per month. He must be fully capable of handling up-to-date electrical machinery, sober and industrious; might be necessary to use the man for outside line work in the event of a change of shift; not much of it however. We use water power entirely. Price of board, room in hotel, about $30 per month. Finest climate on the globe. Nice town, right up-to-date" Address J. L. B., care ELECTRICITY.

The A. Andujar Company, 136 Front street, New York, is advised by its branch house in Barcelona, Spain, that there is a great demand for all kinds of electrical machinery in that country. The above company has a number of inquiries on hand for the same, and desires to secure the agency of some reliable manufacturer in this line, as it is confident that it can do a large amount of business. The company would like to receive catalogues, etc., from some manufacturer in this line who is disposed to give it the exclusive agency for Spain.

COMING ELECTRICAL EVENTS

American Street Railway Association—Convention, New York City, October 9, 10 and 11.

American Electro-Therapeutic Association—Buffalo, N. Y., September 24, 25 and 26.

Old-Time Telegraphers' Association and U. S. Military Telegraph Corps—Convention, Montreal, September 11, 12 and 13.

INCORPORATIONS.

The Moberg Electric Clock Company, New York City Capital stock, $350,000. Directors: A. E. Schatz and George Meier, Mount Vernon, and J. M. Lincoln, New York City.

The Mayaguez Electric Company, Trenton, N. J. Capital stock, $100,000.

The Texas State Fair Miniature Electric Railway Company, Dallas, Tex. Capital stock, $3,000. Incorporators: A. P. Lipscom Henry Garrett and Wallace Stroud.

The Cooper Electric Railroad Gate Company, Dover, Del. —to deal in all kinds of electrical works, motors etc. Capital stock. $150,000 Incorporators: Thomas O. Cooper, Wilmington; John L. Hall, Philadelphia, and James F. Dunleady, Camden. N. J.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED SEPT. 3, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

681,780. Signal for Electric Railroads. Harry T. Gibbs, Portsmouth. R. I., assignor to the Gibbs Electric Signal Company, same place. Filed Feb 20, 1901.

681,891. Trolley-Arm for Electric Cars. James F. Snow, Pawtaucket, R. I Filed Feb. 19. 1901.

681,938. Trolley. Hugh Smith, Watervliet, N. Y., assignor of one-half to John H. Jones, same place. Filed Jan. 7, 1901.

682,056. Contact for Underground Trolleys. Joseph S. Garzousi, New York City. Filed July 10, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

681,692. Electric Incandescent Lamp. Patrocles A. Gibbins, New York City. Filed Feb. 18, 1899. Renewed Jan. 16, 1901,

681,754. Safety Device for Automatic Electric Gas-Lighting Apparatus. Henry C. Thomson, Boston, Mass., assignor, by mesne assignments, to Electric Gas Lighting Company, of Maine. Filed Aug. 6. 1900.

681,992. Flasher for Electric Lamps. Clyde Slusser, Danville, Ill. Filed April 15 1901.

682,101. Arc-Lamp. Joseph C. Mayrhofer, New York City, assignor to John C. Cady, Jr , and Robert B. Ward, same place. Filed July 27. 1898. Renewed Feb. 12, 1901

682,116. Electric-Light Attachment. Joseph H. Rusby, Nutley, N. J. Filed Oct. 20, 1900.

ELECTRICAL MACHINERY AND APPARATUS.

681,716 Electric Circuit Controller. Harry W. Leonard, New York City. Original application Filed March 27, 1899. Divided and this application filed April 9, 1901.

681,776. Electric Switch. William F. Bossert, Utica, N. Y. Filed May 20. 1901.

681,800. Stationary Armature and Inductor. Oskar Lasche, Berlin, Germany. Filed June 18, 1901.

681,885. Means for Braking Electricity Meters. Felipe Saldana, Paris, France. Filed May 22, 1900.

681,943. Electric Switch. Christian F. Ziegler, Chicago, Ill. Filed May 4, 1901.

681,964. Machine for Leveling Electrotypes. Charles Hurst, Brooklyn, N. Y. Filed June 15, 1901.

682,093. Control of Alternating-Current Motors. Rene D. de Lignieres. Paris, France. Filed March 22. 1901.

682,108. Time-Regulator for Electric Motors. Max M. Movshovitch. New York City. Filed March 19, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

681,724. Telephone Exchange System James L. McQuarrie, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 10, 1898.

681,742. Connection Counter for Telephone Lines. Charles E Scribner, Chicago, Ill. assignor to the Western Electric Company, same place. Filed Nov. 22, 1897.

681,743, Switchboard for Telephone-Lines. Charles E. Scribner, Chicago, and Frank R McBerty, Evanston, Ill., assignors to the Western Electric Company, Chicago. Ill. Filed Dec. 26, 1899.

681,744. Telephone Call-Bell. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company same place. Filed Jan. 20, 1900.

681,812 Support for Telephone Apparatus. Elias E. Ries, New York City. Filed Sept. 19. 1898.

681,813. Support for Telephone-Transmitters or other Apparatus. Elias E Ries. New York City. Filed Sept. 19, 1898.

681,860. Service Meter for Telephone-Exchanges. Charles E Scribner, Chicago, Ill, assignor to the Western Electric Company, same place Filed Jan. 12, 1901.

681,878 Telephone Switch Apparatus. Lars M. Ericsson, Stockholm, Sweden, assignor to the Aktiebolaget L. M. Ericsson & Co, same place Filed March 29, 1899.

681,951 System of Electrical Intercommunication. Emery A. Clark, Sioux City, Iowa, assignor, by mesne assignments. to the Clark Automatic Telephone Switchboard Company, Providence, R. I. Filed June 8, 1896.

682,030. Series Telephone System. Charles A. Casperke, Brandenburg, Ky. Filed April 17, 1901.

682,152. Telephone-Exchange Apparatus. Almon B. Stetson, Malden, Mass., assignor to the American Bell Telephone Company, Boston, Mass. Filed May 24, 1901.

MISCELLANEOUS.

681,696. Apparatus for Hauling Electric Cables. Henry B. Grinnell, New York City. Filed Nov. 30, 1900.

681,712. Means for Controlling Electric Currents. Patrick Kennedy, Brooklyn, N. Y., assignor to the American Railway Electric Light Co., of West Virginia. Filed March 26, 1898. Renewed April 1, 1901.

681,721. Driving Gear for Automobiles Samuel D. Mott, Passaic, N.J., assignor, by mesne assignments, to Motor-mobile Company Jersey City, N. J. Filed Dec. 4, 1900.

681,725 Electrical Flush Receptacle and Plug. William J. Newton, New York City. Filed Oct. 10, 1899.

681,730. Electric Piano Player. Timothy B. Powers, New York City, assignor to the Magnetic Piano Company of New Jersey. Filed July 11, 1900.

681,739. Electric Igniter. Frederick A. Ruff, Detroit, Mich. Filed Dec. 3, 1900.

681,757 Insulator. Heinrich Traun, Hamburg, Germany. Filed Dec. 7, 1900.

681,763. Art of Developing Static Electricity. Rome V. Wagner, Chicago, Ill, Filed March 7, 1901.

681,768. Regulating and Controlling Electrical Translating Devices. Granville T. Woods, New York City, assignor by mesne assigments, to Harry Ward Leonard, East Orange. N. J. Filed Jan. 14, 1895.

681,779. Electric Clock. Oscar A. En Holm, Pleasantville, N. Y., assignor of one-half to Homer W. Hedge, New York City. Filed Oct. 1. 1900.

681,862. Device for Controlling the Operation of Electrical Devices. Emory Stockwell, Stamford, Conn., assignor to the Yale & Towne Manufacturing Company, same place, Filed Dec. 31, 1894.

681,868. Connecting-Plug for Telegraph Switchboards. Joseph A. Bowen, Millvale, Pa., assignor of one half to Harry J. Bowen, Wilkinsburg, Pa. Filed Dec. 8, 1900.

681,932. Telegraphic Recording Apparatus. John F. Skirrow, East Orange, N. J. Filed Jan. 25, 1901.

681,939. Electrical Musical Instrument. Rocco L. Venuto, Kansas City, Mo. Filed Aug. 7, 1900.

681,957. Electric Type Writer. George H. Ennis Troy, N. Y. assignor, by mesne assignments, to Electric Typewriter Company, Buffalo, N. Y. Filed March 24. 1900.

681,965. Apparatus for Transforming Alternating into Continuous Currents. Maurice Hutin and Maurice Le Blanc, Paris, France, assignors to Societe Anonyme pour la Transmission de la Force par l'Electricite, same place. Filed Jan. 5, 1900.

681,981. Reproducer for Phonographs. Evans E. Russell, New Haven, Conn. Filed June 10, 1901.

681,999 Art of Transmitting Bodies by Means of Electromagnets. John P. Swift, Pawtucket, R. I. Filed Sept. 10, 1900.

682,006. Electrical Control of Flow of Water to Basins of Washstands or Lavatory-Bowls. Isaac G. Waterman, Santa Barbara, Cal. Filed Feb. 23, 1901.

682,007. Electromagnetic Apparatus. Isaac G. Waterman, Santa Barbara, Cal. Filed April 19, 1901.

682,084. Electric Temperature Indicator. Frank L. Jobson, Richmond, Va. Filed Aug. 15, 1900.

682,088. Electric Furnace. Fredrik A. Kjellin, Gysinge, Sweden. Filed March 13, 1901

682,089. Medicinal Electrode. Orville L. Leach, Providence, R. I. Filed June 6, 1901.

682 155. Electrolytic Apparatus for Extracting Precious Metals. Charles P. Tatro and George Delius, Seattle, Wash. Filed Jan. 15, 1901.

DESIGNS.

35,028 35,029. Bracket for Electric Wires and Cables Geo. A. Ricker, Buffalo, N. Y. Filed May 10, 1901. Term of patent 3½ years.

35,030. Storage Battery Plate. John Bell Conrad, Chicago, Ill. Filed April 10, 1901. Term of patent 7 years.

REISSUE.

11,930. Electric-Arc Lamp. Daniel Higham, Winthrop Highlands, Mass., assignor to the General Electric Company of New York. Filed July 20, 1901. Original No. 675,599, dated June 4, 1901.

THE TELEPHONE WORLD.

Independent Telephone Lines Increasing the Area of Service.

A report from Wheeling, W. Va., states that the National Telephone people claim that they will shortly complete their connections with the independent lines west of the Ohio River to put subscribers in touch with Cleveland and other points in Northern Ohio. The National & Belmont line is being extended to Barnesville to connect with the trunk line system extending from Cleveland by way of Newark, Zanesville and Cambridge, and now being completed to Barnesville, where it will join wires with the National-Belmont. By means of this trunk line connection all the Ohio River towns having the National 'phone will be put in touch with all the principal towns and cities in Northern Ohio.

This is not the limit of the independent lines. Pittsburg and intervening cities are to be connected by an independent line before snow flies. It is now as far as Steubenville. Service over the National has already improved since its installment in Wheeling

News received from Greensburg, Ind, affirms that the new Decatur County Independent Telephone Company has recently increased its capital stock to $20,000, all of which has been paid in. The company now has over 150 miles of pole lines in the county, and is at work extending its lines to Millhousen, Newpoint and Westport. The company was organized less than a year ago, and now has 525 subscribers, and the directors expect to have 1,000 subscribers before another year. The company has a fine exchange, it being constructed on the central energy system. Many farmers are interested in the company, and the directors have many applications on hand for country 'phones. The company has long distance connection with Indianapolis, Rushville, Richmond and many other places in the State.

The Independent Telephone Exchange at Greenville will pass into the hands of the Citizens' Telephone Company of Grand Rapids, Mich., October 1. Negotiations have been in progress for some months. W. B. Serviss will be continued as manager there. The Greenville exchange has nearly 300 telephones in service and has been in operation over three years. The Citizens' Telephone Company now has 33 exchanges outside the city, and the Ionia exchange will make 34. The People's Telephone Company of Detroit will soon absorb the Oakland County Telephone Company of Pontiac. Options on a majority of the stock were secured some time ago and it is stated will be taken up before their expiration. The independent companies of the State of Michigan are forming a working arrangement, which if carried out, will give nearly all the places of importance in the State independent toll lines.

The Elizabeth Telephone Company of Elizabeth, N. J., which was organized six years ago, has been sold to Barker Gummere, of Trenton, and J. L. Hammell, president of the Trenton Trust Company, who, it is understood, are interested in the Interstate Telephone Company.

A Worcester, Mass., paper says members of the Republican city committee are talking of asking the city council to authorize the installation of telephones in the several polling places for use on election day, The immense amount of time and labor that could be saved can be easily appreciated by those who have had to do with election day matters.

The Boyd's, Md., Telephone Company, which runs throughout Montgomery, Frederick and Carroll Counties, has sold out the controlling interest in its stocks to another company, which, it is said, will install more modern 'phones and methods. The stock sold at par, and over 300 of the 500 shares were sold.

The Illinois Telephone & Telegraph Company has completed arrangements for entering Chicago. A trust deed has been filed to secure a bond issue of $5,000,000 to install a big plant. The company is organized to compete with the Chicago Telephone Company.

The Cumberland Telephone & Telegraph Company has opened offices at Maple Hill, Oakville and Capleville, Tenn. Lines are being extended to Oxford, Water Valley, Columbus, Miss., and intermediate points.

Lightning has caused considerable damage to the Colorado Telephone Company's toll line and local exchange at Las Animas.

The Calhoun Telephone Company of Hardin, Mo., has increased its capital stock from $5,000 to $15,000.

The Cumberland Telephone & Telegraph Company of Tennessee has $201,732 capital invested in Indiana.

Independent Telephone System for Kansas.

Representatives of four big independent telephone systems covering all that part of Kansas north and west of Topeka, met a short time ago and organized the Kansas Union Telephone Company with a capital stock of $100,000. Eight hundred miles of toll lines are represented, giving connection with over 200 different towns.

Topeka will be the central point for the big independent system. Work will be commenced on a through double metallic circuit from Topeka to Salina, passing through Alma, Manhattan, Junction City, Abilene and Solomon.

It is proposed to extend from Topeka in four directions, including the line now being built to Salina. This will cover the entire State, and include all the independent telephone exchanges in Kansas.

The Kansas Union Telephone Company is composed of the J. H. McMahan Independent Telephone system of Alma, the Salina Independent Telephone Company, the Abilene Independent Telephone Campany and the Wareham-Wood Company of Manhattan. The new company will be strictly a toll line company. The owners of local telephone exchanges will retain their ownership, but all toll lines owned by the four companies will be appraised and stock in the new company issued to the appraised valuation of the lines.

It is likely that the new concern will be incorporated under the laws of Kansas. Until the incorporation papers are filed the names of the directors of the corporation will not be given out. Directors were elected at a recent meeting.

By December 1 it is expected that the consolidation of the four companies will be complete and that Topeka will have telephonic communication with the whole combined system.

B. F. Pankey, who was granted a franchise by the city council of Topeka to establish a local exchange, is one of the stockholders in the new corporation and will operate an independent exchange in Topeka in co-operation with the company toll lines. The Kansas Union Telephone Company will not be financially interested in the Topeka exchange. That will be Mr. Pankey's own investment. But all of the Pankey 'phones in Topeka will be in connection with the independent toll lines.

When the toll line west of Topeka is in complete working order a line is to be built south through Council Grove, Newton and Wichita. Another line will extend to the northeast quarter of the State and the fourth line will cover the southeastern portion.

B. F. Pankey, when asked in regard to the plans of his local company, said:

"We expect to comply in all respects with the terms of our franchise. We will put in telephones for whoever wants them. For the present I do not care to announce a schedule of rates. I am confident that I will have no trouble in getting all the subscribers I want, and as fast as I can take care of them. We expect to begin work on our lines at once. We have one car load of poles in town and eight more on the road."

The stockholders of the Bowling Green, O., Telephone Company held a recent meeting, and took steps to re-incorporate the company with a capital stock of $200,000. The name of the company will be changed to the Wood County Telephone Company. W. R. Barkdull was promoted from the position of manager of the local exchange to contracting agent. The company proposes extending its lines at an expense of $60,000 to include all the towns and villages in Wood County.

The Twin City Telephone Company will install an independent exchange in the St. Paul, Minn., city hall and court house, donating the service free for one year. There will be 40 'phones, and the city hall exchange will be connected with central by eight trunk lines.

One of the most peculiar freaks of a recent storm which caused so much damage in Minneapolis, Minn., was a telephone there that had been out of order for some days. Immediately after the storm it worked like a charm, and it is now in good order.

The Rensselaer, N. Y., Telephone & Telegraph Company, has decided to increase its capital stock from $150,000 to $300,000, and to immediately go on with the construction of the plant and wire system. The contract for construction was awarded to the Eastern Electrical Construction Company of Philadelphia.

The Hudson River Telephone Company has extended its lines, so that White Lake and Mongaup Valley, both in Sullivan County, N. Y.. are in communication. The line is also nearly completed to Narrowsburgh.

Adverse Legislation Stops Telephone Work in Louisiana.

The Cumberland Telephone & Telegraph Company has abandoned all of its work of improvement in New Orleans and has sent away its entire squad of canvassers in that city, discharged other employes, and is operating there on a minimum of expenditure. The action is the result of adverse legislation by the city council, which required the lines of the telephone company to be removed, a fine being fixed for every pole left standing.

The company took the case to the courts at once, and pending action has called off improvements which would have cost $750,000. The plans which have been abandoned embraced the parallelling of the New Orleans and Northeastern Railroad to Meridian, Miss., and intermediate points; a trunk line from Alexandria to Lake Charles, a line from Lake Charles to Shreveport, with branch lines radiating to the more important towns in Western Louisiana, including the building of 28 excehnges at different places in the State, the whole, together with improvements in New Orleans, requiring an outlay of $750,000. The result of the ordinance has been the cutting off of all work there, and increased activity in Kentucky and Missouri.

According to Chicago advices members of the Illinois Manufacturers' Association are considering municipal ownership as a possible project for the improvement of the telephone service and reduction of the charges. It is said that City Electrician Ellicott, of Chicago, who has received a communication from the association asking for information relative to the city conduits and electrical wiring with a view to its use in connection with a municipal plant, is preparing a report on the subject. The chief point about this move is that it indicates that the association proposes to fight the rates of the present company.

Mr. Wasson, of the Farm & City Telephone Company, which was granted a franchise by the council of Clinton, Ill., a short time ago, states that the company will start immediately to improve the service. Six thousand dollars will be expended in putting in metallic circuits, and a switchboard for 50 'phones will be added as soon as possible. The company will have its general offices at Clinton.

The establishment of a rural telephone line through the Nasonville district, located in the northwestern part of Wood County, Wis., which has been talked of for several months, is now an an assured fact. A mutual line will be built from Lindsay to strike the line of poles of the Wood County toll system at Klondike, a distance of nine miles, with 'phones at the homes of a number of farmers.

L. S. Black of Boston, representing the New England Telephone & Telegraph Company, has recently been in Millbury, Mass, trying to work up interest in a local telephone exchange.

The Independent Telegraph & Telephone Company of Delaware County, Pa., will ask Chester city councils for the privilege of putting its wires underground.

According to a Rochester, N. H., paper, a telephone for the use of the conductors has been completed along the line of the electric railroad with boxes at various points.

The stringing of the wire of the Chippewa Valley Telephone Company from Barron to Ladysmith, Wis., has been completed,

The Kinloch Telephone Company will shortly commence work on its line to Mascoutah, Ill.

The De Pere, Wis., telephone system is being rebuilt at an expense of several thousand dollars.

TELEPHONE INCORPORATIONS.

The Orange Telephone Company, Orange, Tex. Capital stock, $40,000. Incorporators: Melville D. Shaw, Walter D. Bettis, C. N. Haskell, J. S. Brailey and others.

The People's Telephone Company, Jackson, Mich. Capital stock, $200,000.

The Kiowa Telephone Company, Hobart, Kiowa County, Okla,. Capital stock, $25,000. Incorporators: J. P. Eldy, Eldon, Ia.; W. D. Davis, Pulaski, Ia.; and J. P. Evans, of Hobart.

The Farmers' Independent Trunk Telephone Association, Taylor Ridge, Ill. Capital stock $2,500. Incorporators, Peter Eckhardt, W. H. Miller and Almon A. Buffum.

GENERAL ELECTRICAL NEWS.

Lighting.

Auburn, Neb.—Business men contemplate building an electric light plant here.

Berkeley Springs, W. Va.—John T. Mason of Hancock, Md., and others have asked for the incorporation of the Berkeley Springs Light, Heat & Power Company.

Charleston, W. Va.—Samuel B. Noles of Wheeling represents parties who have recently acquired the electric light plant, gas works and water system in this city, and who propose expending $200,000 to extend and improve the plants if certain municipal contracts are awarded to them.

Dalton, Ga.—This city will vote on issuing $6,000 in bonds for an electric light plant. Address city clerk.

Decatur, Ga.—This town is soon to have electric lights, and a petition asking for a franchise to construct the system has been filed with the city council by G. W. Martin, representing a private company.

Hatboro, Pa.—Negotiations are under way for the transfer of the Hatboro electric light and water plants to Philadelphia capitalists.

Holley, N. Y.—The taxpayers will vote soon on the question of establishing an electric light plant to cost $15,000 to be owned by the village.

Jamaica, Vt.—It is rumored that this town is contemplating putting in an electric light plant.

Lake Charles, La.—A mass meeting was held recently to discuss the advisability of the city purchasing the electric light and waterworks plant. The price asked for the plant is $140,000. Committees were appointed to inspect and report. It is thought that the result of their findings will largely influence the city council in calling an election for the purpose of issuing bonds to make the purchase.

Laporte, Ind.—The Laporte County Electrical Company, with a capital stock of $60,000, filed articles of incorporation recently. The company will operate a light, power and heating plant in this city, and will do business here and in Michigan City. The directors are W. A. Boland, D. F. Davis, W. A. Foote, C. H. Holmes and L. Darrow.

Laurinburg, N. C.—The people of this place are preparing to have waterworks and electric lights put in.

Live Oak, Fla.—The electric light franchise for this town has been granted to the Live Oak Manufacturing Company. The work of construction will be commenced at once by Geo. E. Potter, proprietor of the company.

Nebraska City, Neb.—A recent storm damaged the electric light plant considerably.

New York City.—Sealed bids or estimates will be received by the committee on buildings of the board of education at the hall of the board, southeast corner of Park avenue and 59th street, this city, until 4 o'clock P.M., September 16, for installing electric light wiring fixtures, and electric bell system in new Public School No. 136, on 4th avenue, between 40th and 41 streets in Brooklyn. Also for installing the same in school No. 137, Saratoga avenue, between Chauncey and Bainbridge streets, Brooklyn.

Oxford, Md.—It is proposed to build an electric light plant, waterworks and ice factory. L. I. McOugle can give information.

Philadelphia, Pa.—It was announced last week that the control of the Kensington Electric Light Company, the only independent electric light company remaining in this city, has passed into the hands of the Philadelphia Electric Company.

Pierre, S. D.—R. M. Pringle, Government superintendent of engineering, has been here lately preparing plans for a new system of sewerage and an electric light plant at the Government Indian school, both of which improvements will be put in this fall.

Pony, Mont.—It is understood that an electric light franchise will be asked for by W. W. Morris and a light and power franchise by the Madison Canyon people in the near future.

Wolcott, Ind.—The Tharp Bros. of Monticello are investigating the matter of establishing an electric light plant here.

Street Railways.

Albany, N. Y.—Capitalists in this section of the State, who are largely interested in traction companies make the positive statement that within from three to five years New York City and Buffalo, 450 miles distant, will be connected by a double-track trolley road.

Arvada, Col.—An electric line is assured for this place. H. R. Brown and R. C. Green are interested.

Atchison, Kan.—Eastern capital has become interested in a proposed electrical line between this city and Leavenworth.

Ballston, N. Y.—The Barrett & Henderson Syndicate of Cleveland, O., which is building an electric road from here to Amsterdam, has purchased the street railroad at Ossining, and will extend the road to Tarrytown, Portchester, Yonkers and other towns in the vicinity.

Belton, Tex.—O. L. Braily and others are interested in the plan to build an electric road between here and Temple, a distance of eight miles.

Bel Air, Md.—It is announced that work on the proposed electric road between here and Havre de Grace is to begin in the near future. The line will be about 16 miles long. A company has been formed with John H. Reckord, of this place, president, and W. B. Harlan, secretary.

Canandaigua, N. Y.—The Ontario & Wayne County Traction Company was lately incorporated with a capital stock of $500,000 to operate an electric road from here to Pultneyville. The directors are John Raines, William I. Parkhurst, J. I. Burnett, Walter H. Knapp and J. H. Pardee, of this place; B. H. Davis and F. W. Griffith, of Palmyra; J. M. Stoddard, of Shortsville, and I. S. Cuyler, of Pultneyville.

Colorado Springs, Col.—Capitalists of this city have organized to build an electric railway to the top of Pike's Peak. The road will cost $500,000 or more. It will start from here or from some station on the Cripple Creek S hort Line. Investigations show that the road can be operated without trouble at the altitude necessary, 14,143 feet.

Denver, Col.—President Frank Trumbull, of the Colorado & Southern, who was in New York City last week, says that the company is considering the advisability of using electricity as a motive power on its suburban lines out of Denver.

El Paso, Tex.—The El Paso Electric Railway Company was lately organized to construct, operate and maintain an electric and suburban railway, with a capital stock of $750,000. Leigh Clark, John Franklin and Herbert C. Williams, all of El Paso, are the promoters.

Elkhart, Ind.—There is talk of an electric line from Coldwater, Mich., to this city.

Fulton, Ky.—This place will in all probability have a new railroad at an early date. A scheme is on foot to build an electric line from here to Tiptonville, Tenn., via Woodland Mills, through Reelfoot Valley.

Indianapolis, Ind.—A traction company under the name of the Central Indiana Railway Company has been formed in this State with a capital stock of $1,500,000. It is to build a line from Indianapolis to Peru. T. M. Boyd and Frank A. Ray, New York capitalists, are interested in the project and are directors. The others interested are from Indiana and Illinois. The track will be constructed as substantially as those used by steam roads for heavy freight trains. The company will be ready for business early in the spring.

Mankato, Minn.—Col. A. E. Johnson, of Minneaplis, states positively that an electric street railway will be built here at once. The Barr Contracting & Construction Company of New York will equip and build the line, taking stock for their services.

Marietta, O.—The Washington County Traction Company has been organized with a capital stock of $250,000 to construct an electric railway between this city and Newport.

Perry, N. Y.—An electric road from here to Silver Springs is projected by Perry capitalists.

Sacramento, Cal.—It is reported that Senator Clark will soon build and equip an electric road from Salt Lake to San Francisco via this city.

Springfield, Mass.—The electric mail service between this city and Northampton for the carrying of an early morning mail north was begun last week.

Syracuse, N. Y.—The State Railroad Commission has granted the application of the Syracuse, Skaneateles & Moravia Railroad Company for a charter to build an electric railroad from Moravia, in the southern part of Cayuga County, to this city.

Manufacturing.

Allentown, Pa.—Local business men are trying to secure the Scott-Janney Electrical Manufacturing Company's plant for this city.

Chicago, Ill.—The United States Accumulator Company, capitalized at $5,000, has been incorporated in this city for the purpose of manufacturing electric apparatus, motors, etc. Max Frank, J. P. Martin and R. S. Clark are interested in the concern.

Company Matters.

Albany, N. Y.—A certificate of change of name of the Colonian City Traction Company of Kingston to the Kingston Consolidated Railroad Company was lately filed with the Secretary of State.

St. Paul, Minn.—The Pipestone Electric Light, Heat & Power Company has filed amended articles of incorporation fixing its capital stock at $50,000.

Power and Transmission.

Fort Worth, Tex.—W. T. Croslen, and J. H. Christian, capitalists of Chicago, and who are at the head of a company with a capital of $1,500,000 for the purpose of harnessing the water power of the Washita River and several streams in the Chickasaw Nation near Davis, say they have succeeded in concentrating a total of 50,000 hp. at that point and will utilize the power to propel manufacturing machinery of all kinds.

Harmony Grove, Ga.—It is reported that L. G. Hardman contemplates buying and developing Hurricane Shoals, erecting an electric plant to transmit the power.

Idaho Springs, Col.—The Seaton Mountain Electric Light, Heat & Power Company, which for the past few months has been greatly improving and adding to its plant in this place, will in a short time have a capacity for generating the largest amount of electric power of any company in this portion of Colorado.

Keokuk, Ia.—Preparations are being made in this place to utilize the enormous power of the Mississippi River that is now going to waste. Before reaching Keokuk the river flows swiftly through a gorge in the limestone that is 12 miles long. The gorge is from 120 to 150 feet deep, and the current there is so rapid that river boats are unable to pass through except at high water. Plans for securing 50,000 hp. at a cost of $3,500,000 have just been completed by Lyman E. Cooley. The work is in charge of the Keokuk & Hamilton Water Power Company of which Charles P. Birge is president; R. R. Wallace, vice-president, and Edmund Jaeger, secretary.

Mines.

Silver City, Idaho.—The management of the Poorman Mine in this city is arranging to equip the property with an electric pump. The electrical energy will be secured from the Trade Dollar Company.

Automobiles.

Bridgeport, Conn.—The location of the Connecticut Fiber Company in this city is considered possible. The concern manufactures armored tires for bicycles and automobiles. Heretofore it has been doing its work in different factories, but the demand makes it necessary for a factory of its own. The officers are: President, E. N. Sipperly, of Westport; vice-president: J. W. Range; secretary, D. R. Beebe; treasurer, Geo. W. Carey, of Stratford.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, September 9, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale.	
		Bid.	Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	34	37
Broadway and Seventh Avenue	100	246	250
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	164¾	165
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	221	221½
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	105	107
Brooklyn City Railway	100	244	245
Brooklyn Rapid Transit	100	68¼	68½
Baltimore United Railways, com	50	16½	16¾
do. do. do. pref	50	91	92
Buffalo Railway	100	110	111
Cleveland City Railway	100	123	124
Cleveland Electric Railway	100	89¾	90
Columbus (O.) Street Railway	100	47	50
Jersey City, Hoboken and Paterson	100	20	23
New Orleans City Railway, com	100	29	31
do. do. do. do. pref	100	101	105
North Jersey Street Railway	100	22	26
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	30	31
do. do. do. pref	100	86	87
St. Louis United Railways, com	100	27½	28¼
do. do. do. pref	100	80¾	82¼
Detroit United Railway	100	74⅛	75¼
PHILADELPHIA.			
American Railways	50	40¼	40⅜
Citizens	50	353½	354
Columbus Railway	100	40	40½
Columbus Railway, pref	100	84½	85
Consolidated Traction of New Jersey	100	68	69
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	24	24½
do do pref	50	60	60½
Dayton Traction	100	50¼	50¾
Fairmount Park and Haddington	50	75	75½
Fairmount Park Transportation	50	26	26½
Frankford & Southwark	50	450	450½
Germantown	50	147½	148
Green & Coates, $15 paid	50	155	155¼
Hestonville Mantua & Fairmount	50	47	47½
do pref	50	73½	74
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	43	43½
Newark, N. J.	100		
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	104	104½
Philadelphia Traction	50	97½	98
Railways Company General	5	2¼	2⅜
Reading Traction	50	32¼	32½
Ridge Avenue, $28 paid	50	308½	309
Rochester	100	25	25½
Scranton and Carbondale	100	19¼	19¾
Second & Third	50	302½	303
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	311	311½
Trenton Street Railway	50		
Union $30 5-6 paid	50	235	235½
Union Traction, $17.50 paid	50	27½	28
United Power and Transportation, $29 paid	25	45	45½
United Traction of Pittsburg	50	14	14½
do do pref	50	30	30½
United Traction of Reading, Pa	50		
West Philadelphia	50	255	255½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	178½	179
West End Street, com	50	96	96½
do. do. do. pref	50	112	113
CHICAGO.			
City Railway	100	206	210
Lake Street Elevated	100	13	13¼
North Chicago	100	190	200
Union Traction, com	100	17½	18
do. do. pref	100	58	60

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale.	
		Bid.	Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	22	22¼
do. do. do. pref	50	95¼	94½
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	49	50
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	93	94
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	144	145

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale.	
		Bid.	Asked.
NEW YORK CITY.			
Electric Boat, com	100	20	22
do do pref	100	47	50
Electric Lead Reduction	100	1½	2½
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	5	6½
do do pref	100	8	11
General Carriage	100	⅞	1
General Electric	100	261½	262
BOSTON.			
Boston Electric Light	100		
Edison Electric Illuminating	100	250	255
General Electric	100	260½	260¾
Massachusetts Electric Companies, com	100	39	39¼
" " " pref	100	93½	93¾
Westinghouse Electric & Mfg., com	50	71	71½
do do do pref	50	80	80½
CHICAGO.			
Chicago Edison	100	160	160½
National Carbon, com	100	17½	18
do do pref	100	85	86
PHILADELPHIA.			
Electric Company of America	50	7¼	7⅜
Electric Storage Battery, com	100	71	72
do do do pref	100	85	86
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	5¾	6

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale.	
		Bid.	Asked.
BOSTON.			
American Telephone & Telegraph Company	100	161¾	163
Erie Telegraph & Telephone Company	100	35	35¼
New England Telephone Company		138	138½
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co.	100	105	110
Commercial Cable Company	100	173	175
Franklin Telegraph Company	100	42	50
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	116	118
Mexican Telephone Company	100	2	2½
New York & New Jersey Telephone Company	100	168	178
Pacific & Atlantic Telegraph	25	70	75
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	
Western Union Telegraph Company		91¾	92
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	112	113
Cumberland Telephone & Telegraph Co	50	136	140
Chesapeake & Potomac Telephone Company	100	67	70
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		75	76
Hudson River Telephone Company	100	120	125
Northwestern Telephone Company, guar	50	122	126
Providence (R. I.) Telephone Company	50	96	97
Southern New England Telephone Company	100	..	..

ELECTRICAL SECURITIES.

Closing Prices—Monday, Sept. 9.

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1¾	2
Eddy Electric Manufacturing Company	25	10	10¼
Storey General Electric	10	11	12
Consolidated Car Heating	100	55	60
Standard Underground Cable	100	218	220
Pratt and Whitney, pref	100	87	88

STREET RAILWAY BONDS.

	Last Sale.	Int. Paid.
ALBANY.		
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100¼	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅞	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¼	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅝@16⅞c.; Lake, 16¾@17c.; casting, 16½@16⅝c.

The Philadelphia Electric Company has bought control of the Kensington Electric Light Company.

The Commercial Cable Company has declared the regular quartely dividend of 1¾ per cent., payable October 1. Books close September 20 and reopen October 2.

The Twin City Rapid Transit Company has declared the regular quarterly dividend of 1¾ per cent. on its preferred stock, payable October 1. Books close September 24 and reopen October 2.

Gen. John I. Sabin, president of the Chicago and Central Union Telephone Companies, recently sailed for Europe. It is said the purpose of his visit abroad is to dispose of stock in his companies.

Vice-Chancellor Stevenson, at Jersey City, appointed W. G. E. See permanent receiver for the General Carriage Company, of New Jersey. E. R. Thomas is the receiver for the New York property of the company.

A receiver has been applied for by minority stockholders of the City and Suburban Street Railway Company of Washington, D. C., on the ground of insolvency and intention of the management to wreck the property.

It is understood in well-informed circles in Toronto that it is only a question of a comparatively short time when the rate of dividend will be increased on both Toronto Railway and Twin City stock. Both issues now pay 4 per cent a year.

The report that certain bonds now held in the treasury of the Brooklyn Rapid Transit Company may be marketed to provide for improvements has brought no direct denials, though some of the highest officials deny all knowledge of any such intention. One gentleman, whose official position should place him in possession of the facts, says the company has now in the treasury between $4,000.000 and $5,000,000 in cash available for improvements, which suggests the possibility that some, at least, of the bonds which it is said might soon be sold, have already been marketed. No information as to the amount of bonds still remaining in the treasury is obtainable.

The recent decline in Erie Telephone was probably due to the fact that the company has been obliged to borrow $1,500,000 additional money from the Old Colony Trust Company syndicate for construction purposes. Of the $7,500,000 furnished by this syndicate the early part of the year only $1,000,000 was provided for needed extensions and improvements. This additional $1,500,000 is raised through the issue of 5 per cent. notes which have been underwritten by the syndicate managers at 99 and accrued interest, and makes the total amount of short term notes now outstanding $9,000,000, all of which expire January 10, 1902. The security back of this additional money furnished consists of notes or stock, or both, of the subsidiary companies.

A union of all the electric railway and electric light companies owned by Philadelphia capitalists is now under way with prospects that the project will be carried to a successful conclusion. This combination will involve over $100,000,000, so says a press dispatch. This report is emphatically denied by Vice-President Widener, of the Philadelphia Union Traction Company, in the following statement: "The affairs of the Union Traction Company are in excellent shape. The company will not be leased, sold, reorganized or merged. We cannot prevent persons from submitting all sorts of propositions any more than we can prevent the publication of the many absurd articles that have been printed concerning the property. No person actively identified with the management of the Union Traction Company is in any way identified with the proposed Pennsylvania Light, Power and Transit Company, of which concern I know absolutely nothing."

Richard Siegman of New York City has begun suit in Chancery at Trenton, N. J., against Martin Maloney, a director, and George H. Day, president, of the Electric Vehicle Company, charging that the company has paid out $200,000 in dividends when losses of $5,000,000 have been sustained during the past two years. Allegations of fraud are made. Discussing the Siegman suit, Counsel Hayes for the company says: "I feel discouraged concerning the company's affairs, but not entirely disheartened. The company has simply been unfortunate in its investments. We made losing investments of $4,000,000 in acquiring stock and properties of other companies. We acquired Mr. Rice's patents for storage batteries. The company also bought the Pope Electric Vehicle Works and patents, at Hartford, paying $1,000,000 therefor. Then we increased the capital stock of our company from $10,000,000 to $12,000,000. We bought the Siemens & Halske plant at Chicago in 1899 for $1,000,000, and lost nearly that much money in the investment. We have since sold the plant. We bought 70,000 shares of the New York Electric Vehicle Transportation Company stock, and have had a shrinkage of about $2 per share on that. We bought 70,000 shares of the New England Electric Vehicle Transportation Company's stock, representing $700,000, and have a loss of about $550,000 on that. Then we bought 4,000 shares of the Philadelphia Electric Vehicle Transportation Company's stock, which represents $400,000. The New England company, like that in Illinois, has been dissolved. Six or seven months ago we acquired the Riker Motor Vehicle Company, and following this increased our capital stock from $12,000,000 to $20,000,000. We have not the least intention of going out of business. We have succeeded in developing our batteries from 20 to 40 miles an hour, and now cannot supply the demand for our vehicles. The company has practically no outstanding debts, amounting as they do to only $25,000 or $30,000.

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As Electricity reaches all classes interested in electrical ork, its value as an advertising medium can be readily understood. Rates will be sent on application.

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EDITORIAL NOTES.

The Nation's Martyr.

The death of William McKinley, Chief Executive of the United States, early on September 14, plunged a nation into mourning. His death was all the more of a shock owing to the general belief, until a few hours before his death, that he had more than a fighting chance for recovery. But the miserable assassin had done his work only too well, and blood poisoning having set in death speedily followed.

That the dead President was a true man and an American in every sense of the word is acknowledged by all, and his death will be no more deplored by any class of men than by the electrical fraternity. During the McKinley administration the electrical industry has grown and flourished as never before, due in great part to Mr. McKinley's conservatism and common sense in administering to the welfare of the country, as well as to the influence he brought to bear in seeking new and foreign markets for our products.

As was to have been expected the news of the President's demise unsettled Wall Street, but not to as great an extent as might have been expected. It is our belief that the foundation of American prosperity is so great and of such an enduring character that not even the sad loss of the country's leader can affect it for any length of time.

As Garfield said when he was informed of the death of Lincoln: "God reigns—and the Government at Washington still lives."

Another Compressed Air Experiment.

Last winter the Metropolitan Street Railway Company of this city devoted considerable time and much money to experimenting with compressed air cars, with the result that this type of car was eventually withdrawn from the line on which the experiments had been conducted and animal power substituted.

In view of the above it is rather surprising to note that the Brooklyn Rapid Transit Company proposes to experiment with compressed air engines. According to a daily paper the company will shortly try a compressed air locomotive in drawing cars from Fulton ferry to Navy street. If it comes up to expectations orders will be given for additional engines, and the electric motor cars and steam engines will be relegated to the background.

The locomotive with which the experiments will be conducted, and which is now lying in a siding in East New York, is of the most modern pattern and weighs about twenty-five tons. Referring to the subject a daily says:

"Brooklyn Rapid Transit officials will pay nothing for the experiment on their road, but are anxious for the test to determine the efficiency of compressed air as a means of moving cars on the different 'L' lines. They also desire to learn whether or not economy will attend the use of the new power."

It is a fortunate thing that the experiment will cost the company nothing, for the experiments conducted by the Metropolitan Company certainly cost that corporation a pretty penny, and with no practical result other than to prove that compressed air was not adapted to street railway service.

* * *

The Engineering Congress at Glasgow

The year's principal event for English engineers, so our London correspondent informs us, is the International Engineering Congress which opened at Glasgow Tuesday, September 3, with 3,000 in attendance. The proceedings were, as usual with such conventions, opened with a presidental address, the president of the Institution of Civil Engineers for the current year being accorded the honors of performing that part of the programme. President James Mansergh had to touch in general upon matters which would have some sort of application to members of the many different sections into which the Congress had, of necessity, to be divided. "Engineers constitute more than a profession; they amount to a race." "Engineering with us does not consist in being, but in doing . . . the really great engineer is born not made." "All other things being equal—adaptability, soundness, efficiency—the engineering work which costs the least money is the best." After more comments of a similar kind Mr. Mansergh said that a good deal of wasted ingenuity would be saved if those who engage in every kind of engineering work would remember to use the money standard, as well as the foot rule and the higher mathematics. Real engineering must be mastered as it is realized on works in progress; it has no authoritative text book. The distinguishing note of modern engineeering is that it subserves in the main the interests of the mass of the people. Mr. Mansergh spoke as follows regarding electrical engineering matters:

"I fear that only too good a case could be made out for the allegation that a mistaken statutory system has discouraged in this country—for the time being at least—the neutralization and development of electrical engineering on the largest scale. In other words, the Electric Lighting Acts had the broad result of chopping up the business of electricity supply in this favored land into morsels reduced to the parochial needs of local authorities. There was no freedom in the business. Instead of the electrical and mechanical development of lighting and power being undertaken in this country upon a scale proportional to its early promise, the work had to be done by "sample"—every small specimen differing from the others. Long years passed before any English engineer was in a position to give out an electrical power contract amounting to £100,000. Meanwhile our friends in America and on the Continent of Europe were forging fast ahead. So we lost our chance, and shall probably have to take other people's electrical plant for some time instead of striking out on our own leading line, as our less governed forefathers did in railway work and shipbuilding years ago."

A large number of papers of interest to the electrical fraternity were presented, among others one entitled "Modern Commutating Dynamo Machinery with Special Reference to the Commutation Limits," by Mr. H. M. Hobart. Mr. Hobart stated among other things that although first introduced so many years ago, the design of the continuous current dynamo did not show that progress which had characterized electrical engineering in general. Great opportunity exists for improvement, and much may be done without radical innovations, merely by making more general use of the technical knowledge of the subject at present at our disposal. One persistent error has been the perhaps natural assumption that the kw. output should be given predominating consideration in laying down the lines of the design, and that the required volt and amperage are of altogether minor importance. This has led to the frequent use of very inappropriate designs, particularly with relation to the commutator, the armature winding, and the number of poles and general construction of the magnetic circuit. Machines of different voltages, but for the same kw. output, have, however, one set of features in common, namely, all those features relating to the amount of mechanical power to be transformed into electrical, or vice versa; in other words, the mechanical design in general. Mr. Hobart described a group of machines designed with due regard not only to these features of mechanical similarity, but also to the points where the designs should diverge in order to suitably comply with the requirements of the different voltage and current ratings. In these machines, the base, stands, bearings, and shaft are the same for all voltages, but while in the low voltage design the electro-magnetic part of the machine is extremely narrow and the commutator wide, the high voltage machine has precisely the opposite characteristics. Since, however, the diameter of commutator armature, field bore, and magnetic yoke are the same for all voltages, it is quite practicable to use to a great extent the same drawings and patterns for all voltages, the patterns being extended or not according as castings for machines of the one or the other voltage are required. Mr. Hobart showed how naturally all this works out, and expressed the opinion that by the use of these principles the best results for a given outlay might be obtained.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

The proclamation by President Roosevelt, designating Thursday, September 19, a day of mourning and prayer in commemoration of the late President McKinley, makes that day a legal holiday. The offices of Electricity will therefore be closed to-morrow.

◆

The American Electro-Therapeutic Association will hold its eleventh annual meeting at Buffalo, N. Y., on Tuesday, Wednesday and Thursday, September 24, 25 and 26.

◆

The expert, Edward Duryea, who was retained by District Attorney Philbin to report on the recent Brooklyn bridge accident, in his report eliminates, it is understood, electrolysis as a factor in weakening the bridge, and gives as the cause deterioration, due to the excessive weight placed upon the structure.

◆

The Cunard liners Campania, Etruria and Umbria are to be fitted with Marconi wireless telegraphy apparatus.

◆

President Vreeland, of the Metropolitan Street Railway, asked Mayor Van Wyck to address the American Street Railway Association when it convenes in this city, October 9, 10 and 11. Mayor Van Wyck referred the request to President Guggenheimer, who will make the address to the association in Madison Square Garden. Elaborate preparations are being made for the three-days' session of the railway men, and President Vreeland said that $40,000 would be spent in entertaining the guests.

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The reconstructed American Line steamship Philadelphia has had a completely new installation of electric machinery, and a larger number of electric lights.

◆

The New York Dock Company, which controls the water front from Catharine ferry to the foot of Van Brunt street, Brooklyn, it is said contemplates building a big central electric power house to operate all the grain elevators and hoisting plants on its docks. At present, each elevator has its own steam engine, while the hoisting is done by donkey engines. The proposition is to establish a big central power house having an engine of 8,000 or 9,000 hp. to operate the dynamos.

◆

Experiments are being carried out in Germany designed to elucidate the details of electric locomotives for the 120 to 150 miles per hour railway, which the German Emperor himself is anxious to see established, not only for military but for passenger transit purposes. It was recognized that even if the train consisted of only one carriage for 50 passengers, as is probable, the carrying capacity of the line being made up by the frequency of the trains, great power would be necessary, and high-voltage alternating currents were desirable to minimize the cost of conductors, etc. A military railway running southwards from Berlin for about 20 miles is to be used for the experiments, and in the course of the next week two locomotives by different firms will be tried experimentally under varying conditions. The voltage is to be 10,000 with a three-phase current, and one main point to be determined is whether the current can be taken from the overhead conductor in sufficient quantity and constancy for the high power necessary to get the speed.

◆

Ten years ago we had about 700 miles of electric railway; to-day about 16,000 miles are in operation in the United States alone: a thousand million of dollars are invested in the stock, and an army of 200,000 men is employed by them, mainly in the great cities, but with steady growth toward all directions.

◆

Work on the rapid transit subway, in this city, is said to be going forward so rapidly that trains will be running on or before September 1, 1903. This is just a year and ten days earlier than was contemplated by the terms of the formal contract which was signed on February 21, 1900. The contract stipulated that the subway should be completed in four and one-half years.

◆

The London County Council has decided to send its tramway manager and chief electrical engineer to the United States to study the latest American improvements and the best system of providing electric traction. The council controls 80 out of the 115 miles of tramway in the British metropolis, and the passing of its tramways bill, which was recently approved by the House of Lords, will enable the council to considerably extend its ownership of private systems in the near future. It will be recalled that the London County Council is now inviting bids for power house equipment which will represent an expenditure of nearly $1,000,000. In addition to this an outlay of over $10,000,000 is estimated for the construction of new tramways approved by the council.

◆

The preliminary trials of the Ganz high pressure traction system upon the lines of the Valtellina-Colico-Sondrio electric railway were made last month. We learn, says the London "Electrician," that the dynamos have supplied their 21,000 volts without trouble, and that the rolling stock has given satisfaction. Report states that the system has shown itself capable of transporting five cars and preserving a speed of 72 km. per hour, even on the up gradients, which are considerable. During the descent of inclines of 14 per cent. the starting of the train is very gradual, and the decrease in load is very marked at the central station, where the gates which admit water to the turbines are partly closed until the motors again take their normal current.

◆

The Appellate Division of the Supreme Court, of this city, in an order entered last week has appointed Theron G. Strong, Thomas C. T. Crain and Henry W. Gray commissioners to hold hearings and report to the court upon the application of the Rapid Transit Commission for the extension of the rapid transit system to Brooklyn. The application was argued before the court on September 4. Mr. Crain was formerly City Chamberlain; Mr. Gray was until recently Special Commissioner of Jurors, and Mr. Strong is a lawyer. Application is to be made on September 30 before the Appellate Division in the Second Department for the appointment of a commission to report upon the portion of the road which lies in Kings County.

THE new electric locomotive which has been introduced on the Central London Railway, with a view to diminishing vibration, differs from its predecessors, which run at three times the speed of those used in the old engines, says an English paper. Gearing is used to reduce the speed to that necessary at the drivers The multiple-unit system is also about to be tried on this line. The train is to be made up of two motor coaches and four trailers, the total weight of which will be 96 tons, or 30 tons less than that of one of the present trains with equal seating capacity.

AN electrical device that may revolutionize prospecting is to be tried in the mining camps near Spokane, Wash. The idea is said to be feasible and based on scientific principles. Ernest Dale Owen, an attorney of Chicago, who is president of the company back of the device, said recently: "Our invention is an electrical apparatus for locating mineral in the earth and for indicating the quantity of the metal and its depth below the surface. It is impossible to give a description of the principle in a few words, but putting it in as short a form as possible, it is this: A streak of metal in the earth has more contactivity than the earth on each side, and we have a system by which we can measure that contactivity as compared to the earth."

IMPROVEMENTS are constantly being made in the electrolysis of metals for various purposes, and in the separation by this means of gold and silver from their compounds.

A BIG deposit of alumina has been discovered in Kern County, Cal., in a ledge from 100 to 600 feet wide, which has been traced nearly 26,500 feet. At a depth of 200 feet the ore is still as wide as at the surface. The property is located seventeen miles west of Mojave, on the Southern Pacific Railroad. The ore is of a decomposed metallic nature, containing iron, magnesia and silica. The assays have run as high as 31 to 35 per cent. alumina. Besides the values of alumina quartz ledges have assayed from $2 to $39 in gold per ton. Samples of the alumina have been sent to the refinery for a test, and a short time will tell whether California can produce aluminum for the markets of the world.

A MOST thorough demonstration of the efficiency of the electric fireproofing process, operated by the Electric Fireproofing Company of Canada, Limited, was witnessed September 11 on the Champ de Mars by several thousand interested spectators, among them being Mayor Prefontaine, Senator Thibaudeau and other prominent officials, as well as many architects, builders and fire experts from Toronto, Ottawa and other parts of the Dominion. A house built entirely of wood treated by this process was tested by placing under and inside of the same a large amount of kindling and firewood saturated with kerosene, which was then set on fire. The structure could not be made to burn, however, and the result of the experiment proved most successful, in that it left the house in almost perfect condition after having been subjected to a furnace heat for over one hour and a half. On the conclusion of the test Mayor Prefontaine expressed great astonishment at the result, and heartily congratulated the company and stated that he hoped to see the day when wood fireproofed by the electric process will be used in all building construction in Montreal.

ACCORDING to an English contemporary a German firm has recently introduced a new cell for military telegraphy which is said to be giving satisfactory results. The electrolyte is a strong caustic alkaline lye, the anode is of zinc and the cathode of carbon, the latter having a resistance which is diminished by embedding it in a thin cruciform perforated sheet of copper. Thus the resistance is brought down to one-hundredth of an ohm. The EMF. of the cell is from 1 2 to 1.5 volts, and when short-circuited it will give a current of 25 amperes. The elements are inclosed in an enameled iron vessel.

A HIGH speed electric railway has recently been opened between Milan and Varese, Italy. The distance of fifty miles is covered in fifty minutes, the train reaching a speed of sixty-six miles per hour. The third rail and four motor cars are used. Power is obtained from the Ticino at Tornavento.

EIGHTY-FIVE entries have been received by the contest committee in charge of the New York to Buffalo automobile endurance run. None of the vehicles entered are propelled by electricity.

A NEW electric propeller for small boats is a combination of motor, propeller wheel and rudder, the novel feature being the use of the motor under water. The propeller weighs about thirty-five pounds and the storage batteries are made so compact that they can be placed under the seats of an ordinary row-boat, two boxes of cells giving a speed of four miles an hour for five to eight hours on one charge. An advantage claimed from placing the motor outside the boat is avoidance of strain and vibration.

IN a recent issue of the "Elektrotechnische Zeitschrift" there appears an article by Mr. Stern discussing two methods of measuring the energy of three-phase motors, viz., the "zero point method" and the "three wire method." The author gives calculations based on a series of measurements to show that both methods are very inaccurate, wherefore he concludes the construction of meters or watt-meters should not be based upon them.

THE principle of an old form of telephone board, says our English namesake, has been revived, in a modified form, in a cabinet board for small exchanges described in a recent issue of the "Elektrotechnischer Anzeiger," and which is now being introduced with the idea of eliminating the troublesome flexible cord. The jacks are arranged in a triangle, so as to give the necessary number of combinations; the jacks being marked with the two lines which they connect. There are thus fifteen 5-point connecting jacks for a 6-line board, the top one being marked 1--6, and the lower row consisting of five. Below this is the row of six local jacks, which are connected to the operator's set by merely inserting a loose plug, just as in the case of the main jacks. At the top of the board is a row of six drop indicators employed both for calling and clearing signals, and a corresponding row of jacks in case connections are to be made to other boards, and to the right and left of the triangle are jacks to connect in the bell and extension bell if required. The boards are made in sizes for from 3 to 20 lines.

EXPORTS of electrical material from New York for a single week in September show the wide range of the business and prestige of American manufactures.

THE "Italia Militaire e Marinia" states that a committee is being formed at Amalfi in Italy to arrange for the celebration of the fourth centenary of the invention of the compass. The Duke of the Abruzzo has agreed to be president of the committee, and Signor Morin, the Italian Minister of Marine, the vice president. The celebration will take place next year.

IN the glass manufacture the method of fusing the materials on a hearth by electricity is said to be giving very promising results. The sand, cullet, and other substances are fed on to the earth continuously by an archimedean screw, and the arc is produced by a direct current of 50 volts, but an alternating current can also be used. Considering the low voltage used, the fusion should be very economical, and especially so when the dynamos are water-driven.

THE Pittsburg Exposition Building is brilliantly illuminated by several thousand incandescent and arc lamps, furnished by the Allegheny County Light Company. The Exposition will close October 31.

A REPORT is received from London saying that German manufacturers of electrical machinery and appliances, impelled by the industrial depression at home, are making determined efforts to capture English markets regardless of profit. Their American and English competitors are sorely disturbed by the suddenness and strength of the German incursion. The German General Electric Company, whose works are on the Spree, has secured the contracts for the generating plant and switchboards for the municipal tramways of Manchester for $400,000, which, it is officially stated, is the cost price with the addition of 5 per cent. profit.

Proposals Invited.

The Commissioner of Indian Affairs is inviting sealed proposals until October 7 for furnishing the necessary materials and labor required to construct and complete a stone addition, with steam heat and electric light, to the Indian school building at Chilocco, Okla. Plans and detailed information will be furnished upon application to Charles W. Goodman, superintendent of the school.

MISCELLANEOUS NOTES OF INTEREST TO CENTRAL STATION MEN.—V.

BY W. H. WAKEMAN.

The closed exhaust steam feed water heater has one great advantage over the open type, for by its use all impurities that may result from the use of cylinder oil are rigidly excluded from the boiler. In all types of open heaters, whether they are common or improved, there is always a chance for something to get into the feed water and be carried into the boiler. Where it is necessary to force a boiler in order to make the required amount of steam, a very little oil or grease that is of a tenacious nature will cause the crown sheet (whether it be curved or flat) to bag, resulting in an explosion if not given prompt attention. In some cases a very thin coating of grease has proved sufficient to do this; therefore the only safe way is to use a closed heater, although open heaters are very efficient, so far as heating the water is concerned.

The use of stationary oil cups for oiling crank pins has become so common that it seems almost unnecessary to call attention to their value where long runs are to be made, but grease lasts so long when used on a crank pin, and it is so much cleaner than oil that some engineers are tempted to use it, but a word of caution along this line will not be out of place.

So long as there is plenty of grease in the cup, and it feeds fast enough to keep the pin cool, there is no complaint to be made, but if it does not feed fast enough, or if it feeds too fast so that the grease is exhausted before the run is finished, there is no way of fixing it while the crank is making 250 revolutions per minute, therefore the engine must be shut down. The use of oil prevents this, as the cup can be filled and the feed regulated at all times.

Where the time for cleaning boilers is very limited, as it is in some stations where there are no spare boilers, it is customary to allow the fireman to fill the furnaces with wood while the water is running into them, before the tubes are all covered. This saves time, and owing to the fact that they should be allowed to stand and cool off as long as possible before commencing to refill them, it may seem to be admissible, but after all it is bad practice and should be discontinued.

Where a boiler is located in a mill or factory the engineer may clean it on Sunday or on some holiday, and then fill the furnace with wood in order to save time the next morning. This is proper provided there is a plenty of water over the tubes, and the furnace walls are cool enough to prevent the wood from igniting before it is wanted. In many instances, however, the engineer has found only some light ashes in the furnace when he wanted to light the fire, making it necessary to get more wood and fill the furnace again. When all things are considered it is better to keep all combustibles out of a boiler furnace until all of the tubes are covered with water and it is time to get up steam.

When selecting a heater for use in a place where there is much lime in the water, one that utilizes live steam is the best, because it requires a greater temperature than exhaust steam at atmospheric pressure possesses in order to precipitate the lime and thus remove it from the water. Although live steam is taken for this purpose it proves to be more economical, even when the use of fuel alone is considered, than to pump in cold water.

This is at least partially due to the fact that feeding hot water promotes circulation of water in the boiler, so that the heat is absorbed to a better advantage.

A heater should always be large enough to allow the water to pass through it slowly, thus taking up the heat in the steam and securing the highest possible temperature in the feed water.

Where water that holds earth in suspension must be used the heater should have a settling chamber, as some of it will be prevented from going to the boiler by such a device.

If you are trying an experiment with a boiler, an engine, or any other part of a plant, which has been suggested by your own thought and study of the subject in hand, then try it in any way that you think proper, but if you are trying one that somebody else has recommended to you, follow out his directions very carefully and note the result.

If you are satisfied that better results can be obtained by substituting some other process, do not mix the two together but try each separately, for this is the best way to determine where the credit belongs.

Do not partially try an experiment that is suggested by another party, then blame him for any unsatisfactory results that you may obtain, because it is not fair to do so.

Several engines now in the market are provided with a concealed wedge for taking up lost motion in the crank pin boxes, which is held in place by two cap screws. When it is desired to tighten a box, one of these screws is loosened and the other one may then be turned a fraction of a revolution so as to draw the wedge until the adjustment is completed. In the case of a horizontal engine, if the wedge draws upward to tighten the box it is all right, because if the upper screw breaks, and I have known several of them to fail without warning, the wedge drops downward, the box is loosened so that it begins to pound, thus giving warning that trouble is coming and enabling the engineer to shut down before serious damage is done.

In one case of this kind it did not take more than 15 minutes to take out the broken cap screw, put in a new one that was kept in stock for such an emergency, and start up again. This shows what can be done by an engineer whose foresight is better than "hindsight."

Suppose that this engine had been designed so that letting the wedge down tightened the box, what would the result have been? The inner half box would have been forced against the pin by the falling wedge, and as this would not have made a noise, the babbitt would melt out before the engineer was aware that anything was broken, making it necessary to shut down for repairs.

When a crank pin box is melted out on account of some accident, or the failure of an oil cup to feed properly, it causes considerable trouble which seems to be unavoidable, hence is not so exasperating as when such a thing is done intentionally. An engineer was discharged for some fault and in order to get revenge he drove the crank pin key down as tight as possible after shutting down the engine for the last time, and when his successor unsuspiciously started up the next morning he could only run a few minutes.

Such unprincipled action is to be condemned under every possible condition, as there is positively no excuse for it. The man who fails to restrain his desire for revenge, is damaged as much if not more than the owner of the damaged machinery, but strange as it may appear he does not seem to realize this fact. The unfortunate man above referred to, was killed on the plant that he was running a few months afterward.

The words "priming" and "foaming" in connection with steam boiler practice are sometimes used indiscriminately, but they should not be as they refer to different things.

A boiler may "prime" for months before the engineer suspects it, if he is not continually watching for trouble, because it will not prevent the engine from running, nor disturb the water level in the boiler. The particles of water are silently taken up and carried off with the steam, entering the steam chest and cylinder where they are not wanted, absorbing heat and carrying it away for no useful purpose, and largely increasing the expense for water where it is bought by meter measurement.

When a boiler begins to "foam" the engineer knows it at once, if he is in the vicinity, and the fireman is sure to see it. The gauge glass becomes useless for the purpose intended, pipes thump and hammer, the engine "labors," and heavy knocks are heard in the cylinder, so that it is necessary to partially close the throttle valve, and perhaps the fires will have to be checked, and some water blown out of the boilers before it will be safe to proceed with the regular work.

This shows that the two processes are entirely different, and should not be classed in the same category.

The feed pipe in every steam plant should have a correct steam gauge attached, and the face of it ought to be in plain sight at all times, for if it shows more than five pounds pressure above what is carried on the boilers, the matter should be investigated at once. In many plants it is customary to close a valve in the feed pipe on each side of the heater, before leaving the boiler or engine room at night. The water cools off and contracts, then when exhaust steam comes through the heater next morning and the heat expands the water there is no outlet for it (provided the valves are tight), consequently a very high pressure is produced that never does a heater any good, and in some cases where packed joints are in use it causes bad leaks.

In one plant with which I am familiar the heater was condemned more than twelve years ago on this account, but the packed joints were renewed and the above mentioned practice discontinued, the consequence of which is that said heater is doing good work to day.

The dealers in boiler compounds are very much interested in proving that scale one-quarter inch thick will cause a heavy loss in fuel, as it prevents heat from passing to the water readily. We know this to be true without their evidence, but is it possible to find one who will guarantee a saving equal to the amount that he claims is lost by allowing the scale to remain?

They seem to be advocating what may properly be called a "poor rule," because it will not work both ways. If we are losing 20 per cent. of our fuel by allowing the scale to remain, we should save 20 per cent. by removing it.

The valve gear of an engine should be oiled more frequently than once in five hours, in order to prevent undue wear. The heat of the steam warms it until we cannot tell by feeling it whether it is dry or not, and said heat destroys much of the value of some oil we use; therefore it is well to oil the gear once in about two and one-half hours, which will be an error on the safe side, if there is any error about it at all.

The exhaust valve of an engine does not perform the cut-off. Remember that when watching the end of your exhaust pipe, for the puffs which come out of it do not tell us everything about what is transpiring in the steam chest and cylinder.

The piston rod of an engine should be exactly in the center of the cylinder. If it is the thickness of a sheet of paper above or below it there is chance for improvement.

With a good direct acting steam pump in use, there is little or no excuse for allowing the water level in boilers, to vary much throughout the run, and it is good practice to keep it as nearly constant as possible.

PERFORMANCE OF AN ARTIFICIAL FORTY MILE TRANSMISSION LINE *

BY WILLIAM S. ALDRICH AND GEORGE W. REDFIELD.

(Concluded from page 149.)

Regulation of Transformers Under Variable Phase Displacement.—An examination of the transformer ratios as determined by the voltage curves at the generator and receiver ends of the preceding curves of performance, will show that for the small hands especially the ratio of transformation at each end of the line varies greatly with the phase displacement. This variation of transformer ratios is a function of the phase displacement depending upon whether it is lagging or leading.

Fig. 11 shows the plotted values of these variable transformer ratios, as a function of the power factor for the step-up and step-down transformers respectively. The load was practically constant, at 1.15 kw., for all of these determinations. The variation in the ratio of the step-down transformers is opposite to that of the step-up transformers.

The following is the general principle for either step-up or step-down transformers, respecting the variation in transformer ratios with variable phase displacement:

The output voltage increases as the lagging phase displacement decreases, which voltage continues to increase as the displacement passes through unity and becomes more and more leading.

This variation of transformation ratio will become apparent upon a consideration of the effect of variable phase displacement upon the resultant flux. In any given case this flux is smaller with a lagging phase displacement than with no displacement, and, therefore, increases as the displacement becomes more and more leading.

Therefore with a given primary impressed EMF. the secondary EMF. will be smaller with a lagging and larger with a leading load, than with a simple non-inductive load. Furthermore, it is to be seen that a difference of phase existing in the secondary circuit of a transformer reappears in the primary circuit some what decreased if leading, and slightly increased if lagging.

PRECAUTIONS TO BE TAKEN WITH UNLOADED TRANSMISSION LINES.

Judging from the results of the earlier sets of these experiments it should not be permitted to throw the generator onto an unloaded transmission line where the per cent. resonant rise may be comparatively large. If this should occur it may produce a marked resonant rise in pressure at the receiver end, and moreover increase the ratio of the step-up transformers. It is therefore advisable always to have induction motors or similar inductive reactance connected in the circuit. Furthermore, in designing a transmission line care should be taken to keep very low the ratio of the charging current to the full load power current, so as not to necessitate increasing the size of generating units to supply this charging current.

Transmission Efficiency.—The tendency to higher efficiency by increase of the impressed EMF., due to any so-called "boosting" throws the current out of phase with its EMF. It is evident that when high transmission efficiency is desired it is necessary to keep down the wattless components of current to whatever cause they may be due, quite as much on the account of the impairment of transformer efficiency as in the general operation of the system. The three transformers used at each end of the line were of 3 kw. capacity, of well-known modern types—Fort Wayne for the step-up, and Packard, for the step-down transformers. In almost all instances in these experiments they were operated at somewhat higher voltages than intended. Their I^2R losses were necessarily increased by the extreme range of reactive loads.

Voltage Regulation.—The results throughout are given for one phase (A—B) of the three-phase system, which was always balanced. There was comparatively little "hunting" of the synchronous motor under any of the conditions of operation. The transformers had a drop of 3 per cent. between no-load and full non-inductive load when operated at their normal voltage. There was also a drop of about 2 per cent. in the speed of the alternator between no-load and full-load, due to the increased slip of the induction motor used as a prime mover. After taking these factors into consideration regarding the regulation of the several parts of the system, it is evident that the performance of the transmission system was satisfactory.

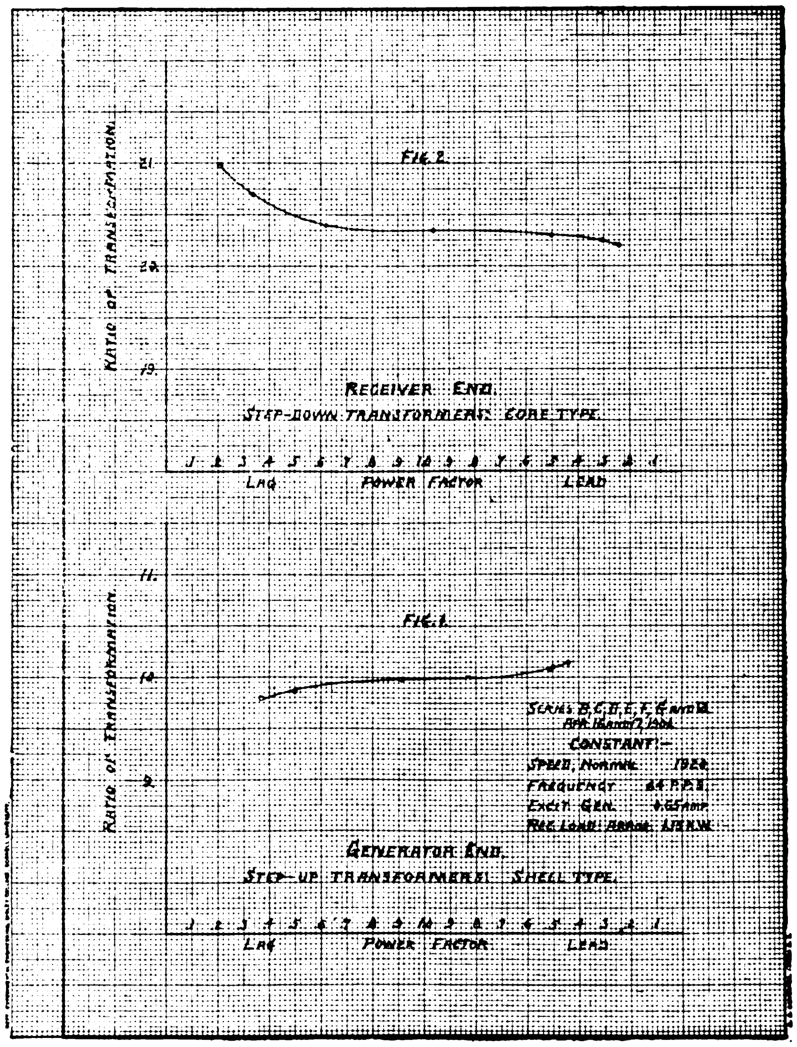

Fig. 11.

Variation of the Transformer Ratios as Function of the Phase Displacement.

Wave Forms from the Experimental Transmission System.*—The instrument used in taking these wave forms was a modification of the Blondel oscillograph. To a small reflecting mirror was attached a very soft Norway iron needle, with a natural period of about one-thousandth of a second. This was suspended vertically by a very fine silk fiber in line of prolongation of horizontal axis of an air-core solenoid of sixty turns of No. 20 (B. & S.) soft single cotton-covered magnet wire. The directive force of the needle was supplied by a pair of permanent steel magnets of horse-shoe form, producing practically a constant field. When an alternating current was passed through the solenoid it produced simultaneous deflection of the needle in frequency, direction and amount proportional to that of the current flowing.

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*Paper read at the 18th Annual Convention of the American Institute of Electrical Engineers, Buffalo, N. Y., August 21, 1901.

*These wave forms were taken by Mr. E. F. Bracken, B. S., in Electrical Engineering, University of Illinois, by the method described in his thesis on "Investigation of the Wave Forms of Alternators and Synchronous Converters," June, 1901.

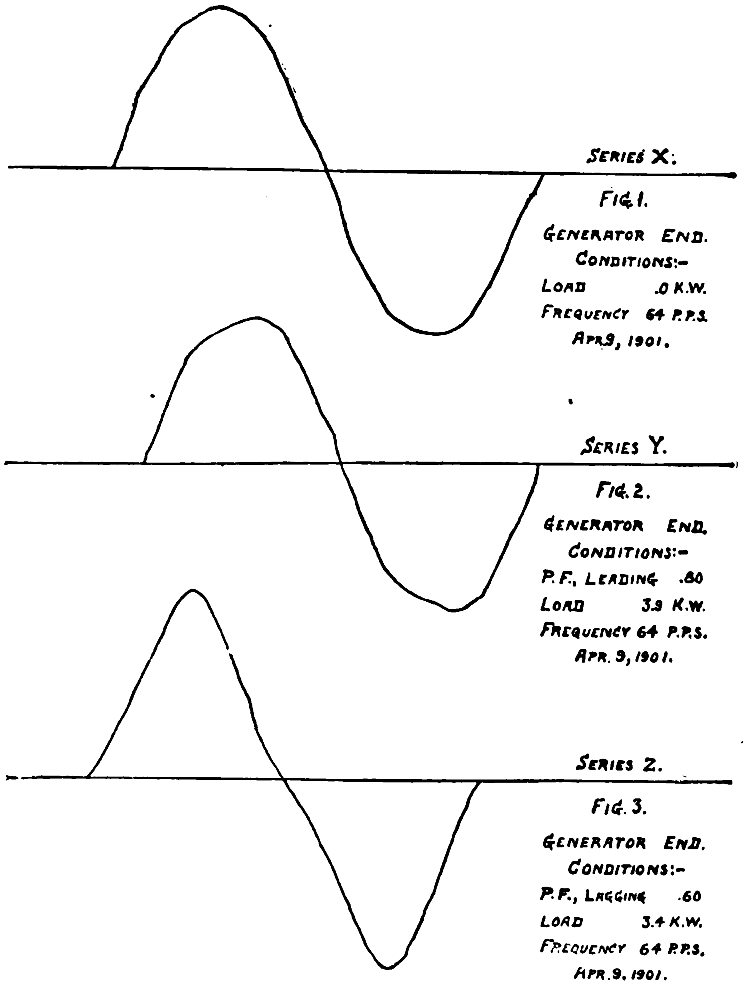

Fig. 12.—Wave Forms from the Generator.

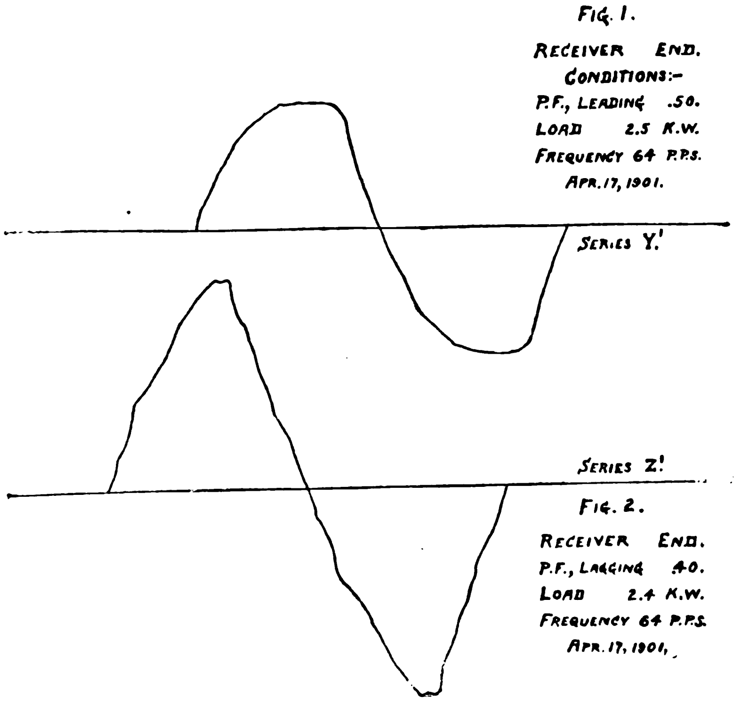

Fig. 13.—Wave Forms from the Receiver Secondary Terminals.

By suitably arranged lenses a beam of light from an arc lamp will be reflected by the mirror upon highly sensitized paper mounted on a rapidly-revolving drum.

The photographic records of the wave forms are necessarily small, from one-half to one inch in amplitude. They were enlarged by throwing onto a screen by a projection lantern and then retraced by hand. Similar recording arrangements have been used with curve tracers. These are necessarily slow and tedious, requiring about half an hour for a complete record of the wave form. The record, therefore, is really a kind of composite photograph, as the wave form meanwhile may have undergone almost an infinite variety of changes. In the modification of the oscillograph as here used the deflections of the needle follow very closely and faithfully any variation in the alternating current, and a record of the wave form is obtained in about one-sixtieth of a second.

Figs. 12 and 13 illustrate the generator and receiver wave forms under typical conditions. Series x is an emf. wave form of the three-phase generator on open circuit. Series y of Fig. 12 and Series y^1 of Fig. 13 are emf. wave forms taken off the generator and receiver secondary terminals, respectively, under the same conditions of load and simultaneous conditions of operation, with leading phase displacement. These wave forms are very similar, but the receiver end is distorted more than the one from that of the generator end, as the receiver end power factor was somewhat lower. They show the flattening due to the capacity effect of the leading currents present.

Series z of Fig. 12 and Series z^1 of Fig. 13 are emf. wave forms taken off the generator and receiver secondary terminals under the same conditions of load and simultaneous conditions of operation, but with decided lagging phase displacement. These waves are also similar, but that of the receiver end is more distorted than that of the generator, due to a lower power factor at the generator end. These waves illustrate the effect of lagging currents and show the characteristic peak due to the presence of inductance. From examination of them it is evident that to wave-form peculiarities are to be attributed many cases of bad regulation and other difficulties appearing in the earlier transmission systems with mixed apparatus and uncertain line conditions. They illustrate also the great influence upon the emf. waves of the line and generator of the phase relation between the emf. and the current.

If synchronous motors or converters are used, giving wave forms quite different from those of their impressed emf., they will become very unstable in regard to remaining in synchronism. This dissimilarity of wave forms also necessitates excessive currents, without any regard to the accompanying disadvantages inherent in phase displacement of synchronous machines, and such dissimilarities are purely relative and do not materially concern the question of the intrinsic value of synchronous machines in effecting neutralization of phase displacement.

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Cheap Aluminum.

A notable article appeared in a recent number of "Pearson's Weekly," in which the writer suggests, amongst other things, that a vast fortune is awaiting the person who succeeds in discovering a method for obtaining cheap aluminum. The author of the article referred to expresses the opinion that, once this is accomplished, iron will then give way, and the white metal will be everywhere. He then proceeds to say that "the millions made by ironmasters will be as a beggar's wealth to that of a Crœsus. Andrew Carnegie, the steel king, made probably fifty millions out of iron extraction and allied trades, yet he is only one man amongst the vast number who have made gigantic fortunes out of iron; he will be a poor man when compared to the aluminum king."

DEVELOPMENT OF THE NERNST LAMP IN AMERICA.*

BY ALEXANDER JAY WURTS.

EXPLANATORY NOTES.—The Hefner unit of candle power has been adopted in this paper so that ready comparisons may be made with results obtained on the Nernst lamp in European countries.

Names of Parts in the Nernst Lamp: The "glower" is the filament or light-giving body. The "ballast" is a steadying resistance connected in series with each glower. The "holder" is the removable piece containing glowers and heaters. The "heater-porcelain" is the porcelain disk in the holder immediately back of the heater. The "heater-case" is a small glass globe used in the six-glower and thirty-glower lamps.

It was in 1897 that Mr. Henry Noel Potter, while in the employ of Mr. Westinghouse, at Goettingen, became acquainted with the Nernst lamp. Early in 1898, Dr. Nernst, Mr. Potter and an assistant came to East Pittsburg at Mr. Westinghouse's request and exhibited the new discovery. Mr. Westinghouse quickly recognized its great possibilities and directed the writer to prepare for its commercial introduction. A happy choice brought Mr. Marshall W. Hanks to my assistance. Mr. Potter returned to Goettingen to study some of the details of the work. In June, 1899, Mr. Edward Bennett joined us, as did also Mr. Frederick M. Goddard a month or two later, who had been assisting Mr. Potter in Germany, but unfortunately in December of that year, Mr. Goddard contracted a violent cold from which he never recovered. In February, 1900, Mr. Murray Charles Beebe joined us and in August of the same year, Dr. Max von Recklinghausen.

I have thus briefly introduced the characters who have worked upon the Nernst lamp in America and without whose names its history would be incomplete; my only regret being that these gentlemen are not all present on this occasion to share in the pleasure of announcing to the American Institute of Electrical Engineers the results of our work upon the Nernst lamp.

THE GLOWER.

It is not my purpose to describe the details of our experiments, but rather to give the results of our work. Let us begin with the glower, so named to distinguish it from the filament of the incandescent lamp.

Our standard 220-volt glower is about 25 millimeters long and .63 of a millimeter in diameter. It is made by expressing from a die a dough made of the rare earths mixed with a suitable binding material, cutting the porcelain-like string thus made into convenient lengths, drying, roasting, and finally attaching lead wires. This sounds very simple, but the making of glowers is an art not easily acquired; it is the result of long and painstaking investigation, particularly with reference to the terminal connection between the glower and lead wire. This connection, as Dr. Nernst made it, consisted of a few turns of platinum wire wound around each end of the glower, the convolutions being finally pasted with cement. This forms a successful and effective terminal, but the shrinkage of the glower ends, away from the convolutions of platinum wire sometimes causes the contact to deteriorate, resulting in the weakening and early destruction of the glower near the terminal. In the Hanks terminal these conditions are reversed. A platinum bead is embedded in the end of the glower in such a manner that any tendency to shrink on the part of the glower material can result only in tightening the contact and thereby maintaining intimate union between the platinum bead and the glower. It is, then, a simple matter to fuse lead wires to the embedded platinum beads.

The glower, as you all know, is a non-conductor when cold, becoming, however, a conductor when heated. It is also an electrolyte; but it may be fairly stated that this phenomenon is not clearly, if at all, understood. Oxygen, however, seems to be necessary, or at least desirable, for its successful operation. As might be expected, no electrolytic action is apparent when operating with alternate current. With direct current, the electrolytic action is quite marked, resulting in a black deposit on the negative end of the glower, which spreads gradually from the negative toward the positive terminal. As this deposit increases, the voltage of the glower changes somewhat, and the candle power and efficiency fall off, owing to the poor light-emitting properties of the blackened portion. The life of the glower on alternating current is about 800 hours; with the same glower on direct current it is considerably less than this. There are, however, radical improvements being made in direct current glowers.

A glower burns at a higher efficiency in its own heat, that is, in a globe, than it does in the open air. We shall refer again to this feature in connection with the multiple glower lamp. The glower is about as strong as a piece of porcelain of the same size, and it is difficult to break a short section. The terminals of a glower give off platinum black, which deposits on the globe; and although this cannot be wiped off with a cloth, it is easily removed in a variety of ways, so that the globe may be considered a permanent fixture in the lamp, and, for that reason, may assume fancy designs. When properly made, the voltage of a glower changes but slightly during its life, the tendency being to rise from 2 to 4 per cent. in 800 hours. For a short time before rupture, the voltage rises rapidly until the glower is broken.

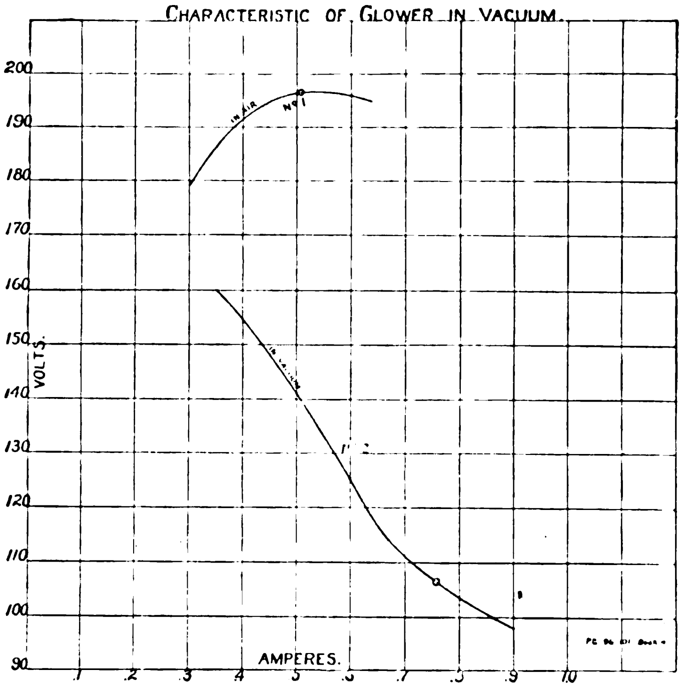

FIG. 1.

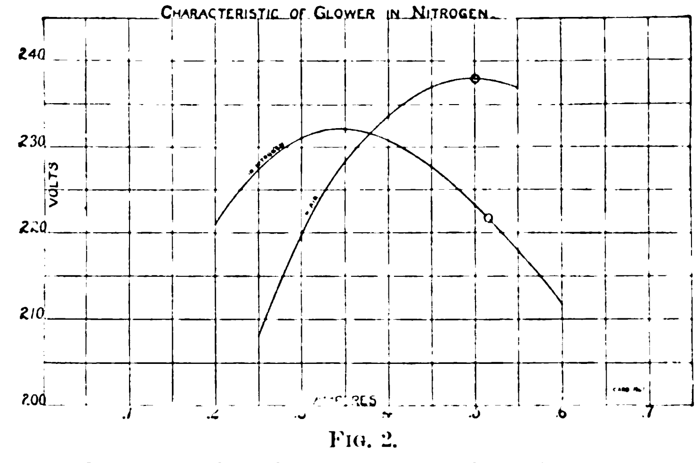

FIG. 2.

The characteristic of a glower with reference to voltage and current is remarkable, and has given rise to the necessity of a steadying resistance. As the current in the glower is increased, the voltage across its terminals rises, at first rapidly, and then more and more slowly to a maximum, beyond which it again drops off with increasing rapidity as the current and resulting temperature through the glower continue to increase. Beyond the point of maximum voltage, the decrease in resistance of the glower is so rapid as to make the current difficult of control. In fact, without a steadying resistance, such a conductor would rapidly develop a short-circuit and flash out. The characteristic of a Nernst glower is shown in curve 1, Fig. 1, the small circle situated near the crest of the curve representing the point of 1.76 watts per candle in the open air.

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*Paper read at the 18th Annual Convention of the American Institute of Electrical Engineers, Buffalo, N. Y., August 23, 1901.

In studying the characteristics of the glower and seeking for methods of operation under the best possible conditions, we naturally exploited the field in various gases including a vacuum, and although the experiments in this direction have not been exhaustive from a scientific standpoint, the results have been negative as far as practical results are concerned, and have demonstrated that for the present, at least, there is nothing to be gained in this direction. The vacuum curve and corresponding air curve are shown in Fig. 1. Aside from the fact that the vacuum has shifted the point of 1.76 watts efficiency to a much lower voltage and higher current density, it will be observed that all the points of the curve now lie on one side, giving a decreasing difference of potential for an increasing current. Such a condition as this involves the use of a relatively large steadying resistance, and renders the operation of the glower inefficient. Fig. 2 shows the nitrogen curve with corresponding air curve, and it will be observed, as in the case of the vacuum, that this gas has also rendered necessary a large steadying resistance and has thereby lowered the available efficiency of the glower. In Fig. 3, we have both the oxygen and hydrogen curves to compare with the air curve. It is interesting to note how closely the oxygen and air curves compare with each other, while the hydrogen curve shows characteristics similar to that of the vacuum curve requiring a large steadying resistance.

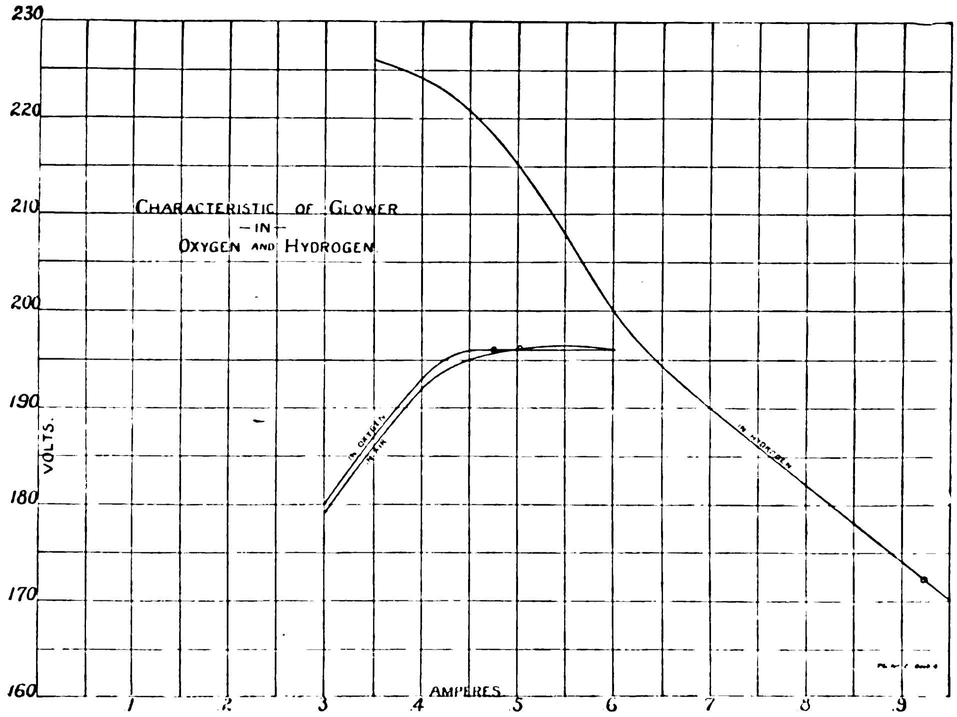

FIG. 3.

There is an interesting phenomenon connected with glowers operating in a space free from oxygen, and which seems to be especially pronounced when operating in a vacuum. Where oxygen is excluded, the glower seems to be sluggish and to respond but slowly to changes in line voltage. The curves in Fig. 4 show this sluggish action in a vacuum. The line voltage is indicated by a dotted line in the upper part of the diagram, beginning with 270 volts. The upper solid curve shows the change of current value during a lapse of time indicated in minutes; while the lower curve shows the change in voltage on the glower during the same interval. Previous to this test, the glower had been run at .25 of an ampere for half an hour, after which the line voltage was raised 20 volts and the current values and differences of potential on the glower were taken at intervals for ten minutes, resulting in the curves shown. Shortly after the completion of this test, the line voltage was lowered 20 volts, when the glower again adjusted itself slowly to the new conditions, and returned to its original current and difference of potential. In air, the glower would have responded almost immediately to similar changes in line voltage. It is likely that the slight changes in both cases after the first minute, are largely, if not entirely, due to the temperature correction of the resistance that was connected in series with the glower.

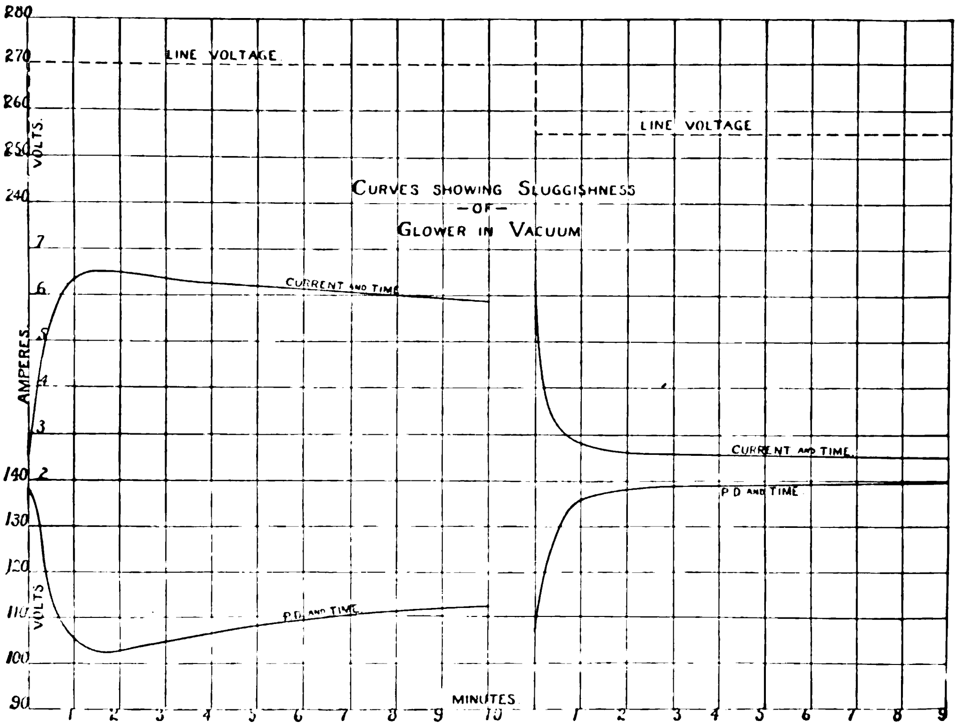

FIG. 4.

STEADYING RESISTANCE OR BALLAST.

The advantage to be gained by the use of a steadying resistance which would enable the glower to be operated efficiently at a point on or beyond the crest in the characteristic curve, was well recognized. To accomplish this under all conditions of commercial use, and with as little loss as possible under normal conditions, the steadying resistance should have as large a positive temperature correction as possible and this temperature correction should always be immediately available. For example, if the glower were operated on or beyond the crest of the characteristic, the current could obviously be controlled by a sufficiently large steadying resistance having no temperature correction, but such resistance would very materially decrease the net efficiency of the glower. On the other hand, if the resistance is assumed to have a high temperature correction, the necessary steadying resistance under normal conditions may be very much less than when no temperature correction is present, and then should there be an increase in electromotive force above normal, the corrective power of the steadying resistance would be brought into play to check any abnormal flow of current through the glower; in other words, to take up the additional voltage; but, as already stated, the temperature correction should be immediately available, for if it were not, the glower would "shoot over" when lighting above the normal pressure, that is, take more current at the start than it would a little later after the temperature correction of the steadying resistance had asserted itself. The same would also be the case with any sudden increase in the electromotive force applied to the glower, unless the corrective power of the steadying resistance were immediately available to check the current flow.

Mr. Potter has designed a steadying resistance or "ballast," as he has named it, which is certainly unique in construction and which meets in a very effective manner, the peculiar requirements of the glower. Iron wire is used on account of its high temperature correction, and by properly mounting this in a small glass tube filled with some inert gas, he has secured a ballast having at once a high corrective power with minimum resistance at normal, and oxygen being entirely excluded, the wire can readily be worked throughout the entire high corrective region without danger of destruction. This remarkable characteristic of the ballast is well shown in Fig. 5, from which it will be noticed that for a 10 per cent. rise in current, the resistance of the ballast increases 150 per cent., so that a glower thus protected becomes at once operative throughout a wide range.

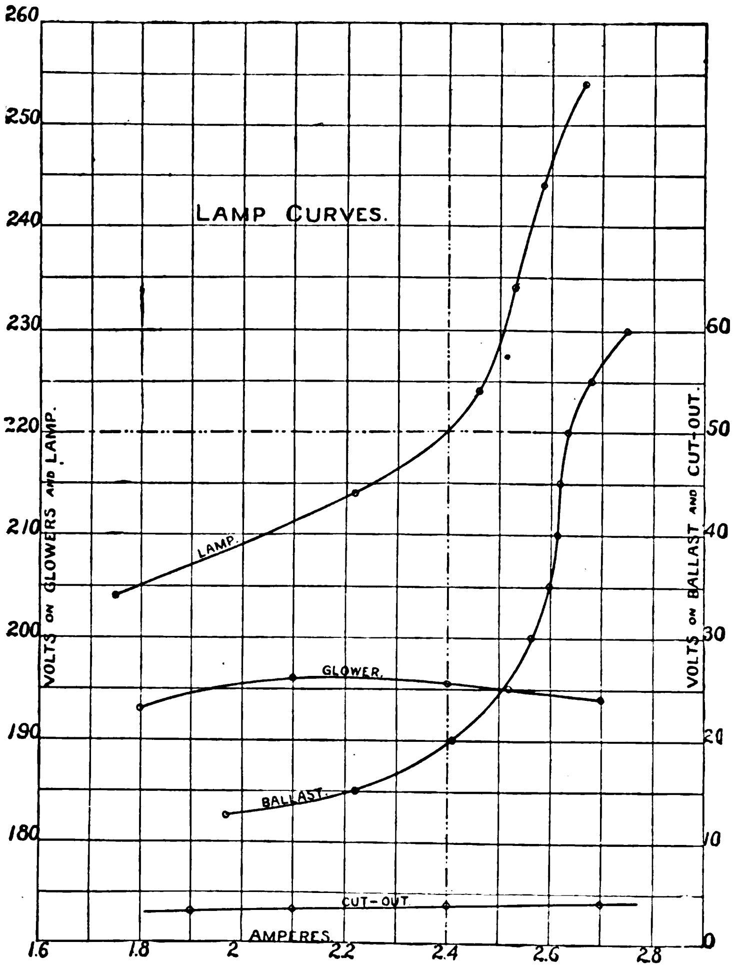

Fig. 5.

THE HEATER.

As already stated, the glower is a non-conductor when cold, becoming, however, a conductor when heated. For practical service in a lamp, therefore, it is necessary that some means be provided for heating the glower and bringing it to a conducting temperature. This topic could well form a subject by itself, but time will permit me to review but briefly the developments made in this direction. Some of the lamps which Dr. Nernst brought with him from Europe were fitted with electric heaters, while others were intended to be heated by an alcohol lamp or even a match. The further refinements of the lamp imposed new and severe requirements upon the heater. It is therefore especially gratifying that we can announce the construction of a simple, satisfactory and effective heater, suited to the requirements of the latest forms of the lamp. The glower is lighted at a temperature of about 950° C., and it will be apparent to all that to acquire such a temperature quickly and without rapid destruction of the heater and adjacent parts, seriously involves the question of materials. Platinum for the heater seems like an undesirable expense in a commercial lamp, and although many attempts have been made to devise a cheap mineral heater, platinum still holds its own as the least expensive, the most durable, and altogether the most desirable material for this purpose; and, after all, the expense is not so serious, because when the platinum heater is burned out, the value of the scrap is nearly 90 per cent. of the original cost, and as the labor is almost negligible, the running cost of the heater is quite small.

As now constructed, the heater consists of a thin porcelain tube overwound with a fine platinum wire pasted with cement, the latter serving as a protection to the platinum wire from the intense heat of the glowers. These tubes are wound for 110 volts and are connected in pairs of two in series according to the service, the one, two, and three-glower lamps taking one pair, and the six-glower two pairs. These heater tubes are mounted on a porcelain support in such a manner as to afford easy access for repairs without removing the glowers. The life of the heater when running continuously is about 200 hours, or 133 hours when the current is turned on and off 4,000 times at regular intervals. Inasmuch as the heater is not called into service for more than about 30 seconds to light the glowers, this would indicate a practically infinite life. In actual service, however, the heater remains in close proximity to the glowers and the high temperature to which it is thereby subjected causes a material decrease in its life. Nevertheless, the life of the heater is surprisingly long, probably several thousand lamp hours. The exact time, however, cannot be definitely determined until a large number of lamps have been operated over a very considerable period in general commercial lighting

(To be continued.)

Convention of the Edison Illuminating Companies.

The 17th annual convention of the Association of Edison Illuminating Companies began on the morning of September 10 in the New York State Building at the Pan-American Exposition at Buffalo.

The Association is composed of officers and other representatives of 50 electric-lighting companies throughout the United States which operate under Edison patents. The membership includes many of the men most prominent in the electric-lighting business. J. W. Lieb, Jr., of New York is president, A. W. Field of Columbus, O., vice-president, and Wilson S. Howell of New York, secretary of the Association.

The forenoon session was occupied with the delivery of President Lieb's annual address, the election of new members and the reports of various committees, the business being transacted in executive session.

The first paper read before the Association was that of Luther Stieringer, consulting engineer and electrical expert to the Pan-American Exposition. His paper was entitled, "The Evolution of Exposition Lighting." His comments on the principal electrical features of the Pan-American caused an interesting debate in the general discussion of the paper which followed its reading. Mr. Stieringer referred particularly to "meddling with the work in hand by outside influences," which resulted in the abandonment of good features, and the neutralizing of others in the illumination of the Exposition.

The discussion of the paper was led by President Insull of the Chicago Edison Company, and President Lieb of the Association, who also is president of the New York Edison Company, and was participated in by many of the members. The discussion, as well as the reading of the paper, was in executive session.

The afternoon session of the Association was devoted to routine business and the reading of an interesting paper on "Timely Lamp Topics," by Francis H. Willcox, and a paper by Clayton H. Sharp, Ph.D., on "Spherical Candle Power of Incandescent Lamps." The reading and discussion of the papers consumed the afternoon and at 5 o'clock the convention adjourned, the members being free to enjoy the evening in viewing the Exposition.

The Association held a session September 11 beginning at 9:30 A.M. After luncheon, the members went to Niagara Falls and over the Gorge route, returning to the Falls for dinner. The party left the Falls to view the rapids, illuminated by searchlights, and then returned to Buffalo.

Dr. A. E. Kennelly's favorable report on the development of the Edison storage battery was listened to with great attention by the delegates.

New officers were elected as follows: President, Louis A. Ferguson, Chicago; vice-president, A. W. Field, Columbus, O.; treasurer, Alex Dow, Detroit, Mich.; secretary, Walter H. Johnson, Philadelphia; assistant secretary, Wilson S. Howell, New York. Executive Committee: Louis A. Ferguson (chairman), Chicago; Charles L. Edgar, Boston; John W. Lieb, Jr., New York; W. C. L. Eglin, Philadelphia; Thomas E. Murray, New York; Samuel Insull, Chicago, and the following ex-officio members: A. W. Field, Alex Dow and Walter H. Johnson.

New York Street Railway Association Convention.

The New York Street Railway Association, that met in Rochester, adjourned its 19th annual convention at noon, September 11, after selecting the following officers and selecting Caldwell, on Lake George, as the convention place for next year: President, G. Tracy Rogers of Binghamton; first vice-president, E. J. Connette of Syracuse; second vice-president, Addison B. Colvin of Glens Falls; secretary and treasurer, Henry A. Robinson of New York City.

The following executive committee was elected: H. H. Vreeland, Metropolitan Street Railway, New York City: W. Caryl Ely, Buffalo Traction Company; T. J. Nicholl, Rochester Railway Company; Jacob L. Greatsinger, Brooklyn Rapid Transit Company.

The convention listened to papers presented on "Steel Tie Construction," by Le Grand Brown, chief engineer for the Rochester Street Railway Company, and on "The Use of Boosters," by William J. Davis of Schenectady.

A long discussion was also entered into on a standard code of rules for the government of conductors and motormen, submitted by a committee appointed for that purpose.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended September 11:

Amsterdam, 3 cases, $144; Antwerp, 33 packages, $1,930; Argentine Republic, 43 packages, $1,840; Australia, 1 package, $450, Barcelona, 2 cases, $230; Berlin, 2 cases, $105; Brazil, 33 packages, $961; 2 cases, $300; Bremen, 1 case, $82; British Possessions in Africa, 18 cases, $1,750; British Guiana, 3 packages, $107; British West Indies, 61 cases, $7,361; Budapest, 1 case, $21; Chili, 1 case, $540; Copenhagen, 7 cases, $540; Cork, 1 case, $10; Cuba, 43 cases, $631; Danish West Indies, 2 cases, $10; Dutch West Indies, 8 cases, $104; Genoa, 8 cases, $195; Glasgow, 19 cases, $686; Hamburg, 9 packages, $6,742; 33 cases, $3,103; Havre, 24 packages, $1,387; Leeds, 2 packages, $55; Liverpool, 86 packages, $16,052; London, 378 packages, $10,370; Manchester, 64 packages, $5,600; Mexico, 59 packages, $5,335; Milan, 8 packages, $225; Naples, 1 packages, $100; Newcastle, 8 cases, $1,400; Peru, 52 packages, $1,754; Southampton, 3 cases, $123; Uruguay, 25 bales, $702; U. S. Colombia, 24 cases, $329.

An Incident of Travel

While in Buffalo recently waiting in the New York Central station for a train we noticed an incident which illustrated pointedly the care which the Central line takes of its patrons and which, in connection with its enterprise and splendid service in other directions, has won for it the title of "America's Greatest Railroad." The station was crowded with waiting passengers, who were vainly trying to make themselves comfortable in the stifling heat, when there entered a middle-aged woman poorly clad and apparently very ill. Her only attendant was a young girl who was puzzled by the crowd and noise of the big station and stood as if uncertain what to do. The sick woman could hardly stand and as no one offered her a seat she seemed about to faint when a young man wearing the uniform of the New York Central stepped up to the couple, inquired their destination, if they had tickets and if their baggage was at the station. He led the fainting woman to an unoccupied seat, procured a fan for her, got her tickets and baggage checks, brought her a glass of ice water, and when her train arrived, calling another uniformed attendant, they led the invalid to a coach and placed her in a seat as gently and with as much courtesy and kindness as if she had been their own mother. They were of course paid to do this service, but that in no way lessened the benefit which the poor sick woman received and the look of gratitude on her face as she reached her car in safety touched more than one heart in the crowd that witnessed the incident. Railroad companies are sometimes spoken of as "soulless corporations," but in establishing such a service for its patrons as this incident illustrates the New York Central certainly deserves exemption from the term quoted.—From the Malone (N. Y.) "Gazette."

PERSONAL MENTION.

Mr. Louis Keim, of Baltimore, Md., has been engaged to test all the meters owned by the Terre Haute, Ind., Electric Company. The company now owns 1,050 meters and has over 900 in service.

Mr. George Bullock, president of the Bullock Electric Manufacturing Company, Cincinnati, O., has returned from a business trip to Europe.

Mr. W. S. O'Donnell, of Baltimore, Md., has been elected superintendent of the new electric works at Fredericksburg, Va.

COMING ELECTRICAL EVENTS

American Street Railway Association—Convention, New York City, October 9, 10 and 11.

American Electro-Therapeutic Association—Buffalo, N. Y., September 24, 25 and 26.

Panic Averted.

The last few days several rumors have had wide circulation, such as "Devery is indicted," "The steel strike is over," and several others. One very persistent rumor, which gained ground rapidly and was heard with dismay among the hardware trade, was to the effect that the supply of "The Green Book of Hardware Specialties," published by the Smith & Hemenway Company, New York City, had proven unequal to the demand and that no more were to be had. Upon being interviewed, Mr. Smith, president of the company, evaded the question for a time, but finally in answer to a direct question said: "While it is true that we are out of 'Green Books' at present our friends need have no fear, for even now we are working on a new and larger edition which we will have ready in a short time, when we will supply them to all who wish them. In the meantime we will supply them with the pocket edition."

INCORPORATIONS.

The Mangum Electric Light & Ice Company, Mangum, Okla. Capital stock, $160,000. Incorporators: J. A. McGeagh, M. Mathews and J. R Lane, all of Mangum.

The Richmond-Washington Company, Trenton, N. J.—to operate railroads, telegraph and telephone lines outside the State of New Jersey. Capital stock, $3,000,000.

The St. Louis & Illinois Suburban Railway Company, Camden, N. J—to absorb the St. Louis Traction Company and several small suburban roads. Capital stock, $3,000,000.

The Hennessey Electric Light & Power Company, Hennessey, Okla. Capital stock, $10,000. Directors: Fred Ehler, J A. Ratcliffee, G. W. Clark, C. R. Gillette and W. C. Stevens

The New Jersey Fire Alarm Company, Hoboken, N. J.—to conduct a fire alarm and general electric business. Capital stock, $100,000. Incorporators: Stanley L. Conklin, Lemuel Emdin and Edmund Vaughan, of New York; Edward A. Brennan, Hoboken.

The Electric Light & Railway Equipment Company, Newburgh, N. Y.—to construct and equip all kinds of electric railway or car lines, electric light, power or steam plants, gas or waterworks, and to manufacture and deal in railway, electrical and other supplies. Capital stock, $60,000.

The Arkansas Development Company, Trenton, N. J.—to build tramways, electric railroads, steamboats and telephone and telegraph systems, as well as engage in general land colonization and immigration business. Capital stock, $1,200,000. Incorporators: Arthur C. Reeves, New York; Marsenus Briggs and Robert Ferrier, Jersey City.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED SEPT. 10, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

682,165. Contact Device for Electric Railways. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company of Pennsylvania. Filed Jan. 8, 1901.

682,187. Trolley-Wire Support. Walter Gerard, St. Bernard, O. Filed Jan. 17, 1901.

682,331. Electric-Traction Road. Leon Dion, Boston, Mass. Filed Jan. 28, 1901.

682,392. Trolley. Jacob A. Thompson, McDonald, Pa. Filed April 18, 1901.

682,540. Electric Switch. Charles E. Gaffney, Pawtucket, and Frank A. Tibbetts, Providence, R I. Filed May 20, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

682,184. Electric Lighting by Low-Frequency Currents. Walter C. Fish, Lynn, Mass., assignor to the General Electric Company of New York. Filed Jan. 26, 1901.

682,337. Manufacture of Incandescing Media for Incandescent Lighting. Rasmus A. Nielsen, Copenhagen, Denmark. Filed July 14, 1900.

682,554. Regulating Device for Electric-Arc Lamps. Paul Kassbauer, Vienna, Austria-Hungary, assignor, by direct and mesne assignments, to Eugen Mytteis, same place, and Oskar Lenck, Oedenburg, Austria-Hungary. Filed June 1, 1900.

ELECTRICAL MACHINERY AND APPARATUS.

682,203. Static Machine. Thomas B. Kinraide, Boston, Mass. Filed March 5, 1901.

682,217. Circuit-Breaker. Frank A. Merrick, Johnstown, Pa., assignor to the Lorain Steel Company of Pennsylvania. Filed Jan. 18, 1900.

682,219. Electric Regulator. Morris Moskowitz, New York City, assignor to James H. Young, trustee, same place. Filed Sept. 27, 1900.

682,220. Automatic Reversing-Switch. Morris Moskowitz, New York City, assignor to James H. Young, trustee, same place. Filed Sept. 27, 1900.

682,336. Electric Sparker for Gas-Engines. Frank R. McMullin, Chicago, Ill. Filed March 8, 1900.

682,340. Condenser. Simeon G. Phillips, Rahway, N. J., Filed Sept. 27, 1899.

682,351. Frequency Indicator. Cummings C. Chesney and William J. Lloyd, Pittsfield, Mass. Filed May 25, 1901.

682,461. Transmitting-Dynamometer. John T. Fanning, Minneapolis, Minn. Filed Sept. 4, 1900.

TELEPHONES AND TELEPHONE APPARATUS.

682,332. Means for Automatically Reviving Exhausted Telephone Pulsations. Morris C. Mengis, Sheepshead Bay, N. Y. Filed Aug. 31, 1899.

682,333. Telephone-Transmitter. Morris C. Mengis, Brooklyn, N. Y. Filed Feb. 15, 1900. Renewed Feb. 12, 1901.

682,458. Telephone-Protector. Alfred Deck, Franklin Township, Montgomery County, Ind. Filed June 12, 1901.

682,536. Mechanism for Removing or Replacing Switchboard Jacks. William S. Paca, Erie, Pa., assignor of one-half to Peter H. Adams, same place. Filed Dec. 26, 1900.

MISCELLANEOUS.

682,175. Elevator and Transfer-Crane for Storage Batteries. George H. Condict, New York City, assignor to the Electric Vehicle Company, same place. Filed Sept. 3, 1898.

682,204. Device for Indicating Leaks in Insulation of Electric Conductors. Isidor Kitsee, Philadelphia, Pa. Filed Jan. 24, 1900.

682,205. Recording Device. Isidor Kitsee, Philadelphia, Pa. Filed March 16, 1900.

682,215. Bushing for Electrical Conduits. Mathias Mauer and William J. Billings, New York City. Filed Feb. 19, 1901.

682,233. Outlet-Box for Interior Conduits. William F. Bossert, Utica, N. Y., assignor to the Bossert Electric Construction Company, same place. Filed July 20, 1901.

682,300. Electrical Power Transmission System. Nathaniel G. Warth, Indianapolis, Ind. Filed Feb. 11, 1901.

682,324. Electric Heater. James P. Erie, New York City, assignor to the Erie Exploration Company, same place and Dover, Del. Filed Sept. 22, 1900.

682,377. Electromagnet. Theodore H. Wurmb and Robert Baumann, St. Louis, Mo. Filed April 9, 1900.

682,380. Electric Belt. Willshire M. Davis Springfield, Mo. Filed April 9, 1900.

682,417. Electric Battery. William Mills, Elizabeth, N. J., assignor to the Eastern Carbon Works, Rahway, N. J. Filed Oct. 3, 1900.

682,424. Repeating Mechanism for Phonographs, John B. Powell, Philadelphia, Pa. Filed Jan. 23, 1901.

682,433. Resonator. John F. Skirrow, East Orange, N. J. Filed Feb. 15, 1901.

DESIGN.

35,072. Storage-Battery Plate. Tracy B. Hatch, Menomonie, Wis. Filed Aug. 12, 1901. Term of patent 14 years.

THE TELEPHONE WORLD.

Telephone and Cable Company Now Controlled by C. W. Morse.

According to the New York "Commercial" of September 11, J. M. Thomas, president of the Telephone, Telegraph & Cable Company of America, said that 245,000 shares of the outstanding capital stock had been deposited with the City Trust Company in accordance with the offer of C.W. Morse. The deposit represents over $2,000,000, more than sufficient to put the terms of Mr. Morse's offer in effectual operation.

This secures to Mr. Morse a controlling interest in the stock of the Telephone, Telegraph & Cable Company, and places in his hands the independent telephone properties of the Knickerbocker Telephone Company of New York, the Massachusetts Telephone Company of Boston, the Boston & New York Telephone Company, and several independent telephone companies in the West, with undeveloped properties claimed to be worth at least $1,000,000. He also acquires 21,000 shares of the stock of the Erie Telegraph & Telephone Company, which added to his former purchase of 30,000 shares, gives him 51,000 shares out of a total of 100,000.

The properties comprise 160,000 telephone subscribers operating under the Bell patents, fully one-sixth of the entire Bell system and 10,000 independent telephones. Mr. Morse will provide for the $9,000,000 Erie loan due January 10, 1902.

The Erie system in the West will form in a degree a part of the Everett independent system, and competition should cease in the Erie's Cleveland and Michigan territory. Erie, under independent management, sold at 122, but when the change to the present management took place dividends were stopped and the stock has since declined to 35.

The acceptance by the stockholders of Mr. Morse's offer, it is said, means the beginning of an active war of competition between the Telephone, Telegraph & Cable Company and the Bell Company. President Thomas, of the former company, said the company he represents is well prepared for the issue.

At a recent meeting of representative citizens from different parts of Nevada County, Ark., a joint stock company was formed for the purpose of extending telephone lines to all important points in that county. It was ascertained that not more than $1,000 would be amply sufficient to connect all points in the county with Prescott and the main line. Among the citizens connected with the enterprise are: Messrs. J. J. Hirst, W. B. Waller, J. C. Young, Senator G. R. Haynie, Dr. J. M. F. Gill, J. B. Munn, Laneburg; Haynie Bros, Rosston, and several others. Some of the main points to be reached by the line are Laneburg, Rosston, Bodcaw, Willisville, Hutts, Sutton and Mt. Moriah. Work on the new lines will begin at once under the superintendence of Mr. T. L. Bayne, who will let contracts for the poles and other necessary material. Mr. Bayne is manager of the Prescott system.

The village trustees of Sag Harbor, N. Y., have granted a franchise to the East End Telephone Company to string its wires through that village. This is not a new company, but has existed for a number of years. The president is J. Edward Hunting, and it has just been reorganized by absorbing the old East End Company, which has for some time maintained private wires between this place and Bridgehampton and thence to Easthampton. The rights of the Amagansett Telephone Company, another small corporation, which also operated a line from Easthampton to Montauk, have been absorbed. The new company has been reorganized with largely increased capital to connect all east end villages as far west as Patchogue, and franchises and rights of way have already been obtained from most of the villages to be benefited. Another future development of the local system is to connect with the west end wires and organize a purely Long Island telephone system.

Manager H. E. Tobey, of the local telephone exchange, has a large crew of men working on a four-wire line for the Central Minnesota Telephone Company west from Sauk Center. They are 10 miles out, and are connecting many of the best farms.

The United Telephone Company of Bluffton and the Indiana Telephone Company of Hartford City, Ind, have been consolidated. The capital of the new company, the United Telephone Company, will be $300,000.

A report from Los Angeles, Cal., states that telephone lines are being extended to connect San Dimas, LeVerne and Lordsburg with the Pomona exchange.

The New York Telephone Company is to erect a four-story brick office building at Nos. 123 to 127 East 124th street, and a similar structure at Nos. 220 to 224 West 124th street. Each building will cost $100,000.

Meeting of Kentucky Telephone Association.

The third annual meeting of the Kentucky Telephone Association, of which R. V. Bishop is president, will be held at Owensboro, October 1. This will be one of the most important meetings of the Association, and it is expected that there will be a large attendance. It is said that several changes in the constitution and other matters that affect the independent situation will be considered. The report of James Maret, the secretary, shows that the Asssociation is in a healthy condition.

"The Illinois Telephone & Telegraph Company will give Chicago a new idea in telephone service within a year," said President A. G. Wheeler, a short time ago. "The telephone user will pay for what he gets, as he pays for gas, and the maximum cost to him per year will be less than half present rates. We shall be ready to install 20,000 telephones in the downtown district by July 1, 1902. We expect to have ten times that number in the whole city just as soon as the construction work can be done. The gas company's meter system is the basis of our plan of dealing with the telephone user. We shall put in a telephone for anybody who wants it —and as many as he wants. He will sign no contract and pay no rental. He will make a deposit of say, $5, to cover cost of the instrument, as he makes a deposit for his gas meter."

The Kinloch Telephone Company of St. Louis, Mo., has at last secured admission to the county seat of Madison County. The Edwardsville city council passed an ordinance granting it permission to install and operate a system. It provided for the carrying of wires in cables, and stipulates the turning in of 1 per cent. of the gross earnings to the city treasury. The action of the council ends one telephone war and opens another. The Central Union, an ally of the Bell in Illinois, fought against the Kinloch's admission to Edwardsville, and since the granting of the franchise has put half a dozen solicitors in the field securing contracts.

The Tristate Telephone Company has filed articles of incorporation with the county clerk of Dubuque, Ia. The capital stock is $100,000. This is a Waukon institution, the men interested representing the Standard Telephone Company. This means that the Standard will be extended into Wisconsin and Illinois. The officers of the new telephone company are: President, Vic H. Stevens; vice-president, E. L. Cass; secretary and treasurer, C. H. Sandbeck. These, with Messrs. J. H. Denfihoff, J. W. Blessing and F. A. Irish are directors and also incorporators.

The work of constructing the independent 'phone system has begun in Sherman, Tex. Work will be pushed simultaneously at Sherman and Denison under the charter recently granted to the Grayson Telephone Company which is authorized to do a local and long distance telephone business in Grayson County. C. T. McCreary, chief engineer of the National Contracting Company, says the long-distance line will be pushed through from San Antonio to Sherman at once.

The Ottumwa Telephone Company of Ottumwa, Ia., is preparing to make improvements upon its system, the cost of which will aggregate $60,000. These improvements will deal with the lines now in operation rather than with building new ones. There will be a few country lines built. New officers were elected; the articles of incorporation were amended in order to allow the increase of the capital stock of the concern to $120,000. The officers elected are as follows: President, F. S. Turner; secretary, G. H. Cowdery; treasurer, I. F. Hubbard.

The Erie Telephone system made a net gain of 1,246 subscribers in August, making a net gain since January 1, of 11,448. The number of instruments connected on August 31 was 153,047, and those awaiting connection 2,522.

Special meetings of the stockholders of the Central Union Telephone Company of Chicago have been called for October 1 and 17 to adjust the capitalization of the company.

The Delaware & Atlantic Telephone Company expects soon to have a force of linemen at work installing the new 5-cent telephones in private residences of Trenton, N. J.

J. D. Carmichael has purchased the Denton, Tex., Telephone Exchange at a price above $10,000 from S. W. McClure.

The Burlington, N. J., city council has granted a franchise to the Standard Telephone Company, which is in opposition to the Bell Company.

From Lynn, Mass., a report is received that commencing September 1 the New England Telephone & Telegraph Company has made a reduction in rates of $3 per annum on all long-distance telephones on unlimited service for both residences and business offices. This does not effect what is known as the "six party" $25 per annum unlimited service. In places where the long-distance service is down to the price of the so-called granular button transmitter service it is the intention of the company to change all of this type of instruments to standard long distance transmitters as rapidly as possible.

Congressman R. F. Bronssard is asking for a telephone privilege in New Orleans, La. He talked over the subject with the mayor and said that he had 525 miles of telephone service in Western Louisiana, and he was anxious to secure an entrance for his company into New Orleans, and that if the company was permitted to come into that city upon reasonable terms he would be satisfied to have the city control the plant, which would be operated in its interest. The mayor said that he would be delighted to see competition with the local telephone company.

The stockholders of the Meigs County, Tenn., Telephone Company, held their annual meeting at Decatur recently. The old officers of the company were re-elected. J. M. Abel president, and J. W. Lillard, secretary and treasurer. The report of the secretary and treasurer showed a considerable balance in the treasury, which the board of directors have decided to use in extending the lines. The company now has in operation about 90 miles of double-wired line.

The residents of Franksville, Wis., have organized a new telephone company to maintain a line from that place to Thompsonville, and it will be known as the Franksville & Thompsonville Telephone Company. It will be a metallic system. The line will be extended to Horlicksville and thence to Racine. The president of the company is G. J. Ellis. Work on the system has been commenced.

The Home Telephone Company of Louisville, Ky. has purchased the telephone system recently established at Sellersburg, nine miles northeast of Louisville. The system is provided with a full metallic circuit, has 100 telephone boxes in use, and is said to be one of the most complete independent plants of its size in Indiana. The local company is now connected with all the important cities and towns of Southern Indiana.

Dissatisfaction at the high rates charged by the Northwestern Telephone Company, says a dispatch from Red Wing, Minn., found expression at the Commercial Club, and a committee was appointed to induce the company to lower its rates, or, failing in that, to invite other companies or organize a local company.

The Fremont, O., Home Telephone Company now has over 600 'phones in use, and a new switchboard for 300 more 'phones has been put in. The Home Company is establishing an exchange at Lindsey with 40 'phones, which will be a part of the Fremont exchange, local subscribers having free use of the 'phones.

A telephone line is to be established between Maysfield and Calvert, Tex. To aid in this project the merchants of Calvert have contributed $800. The Southwestern Telegraph & Telephone Company has agreed to give the new line free long distance connection. Work will begin at once.

City Engineer Tonson has granted a permit to the Toledo, O., Home Telephone Company to excavate and lay a conduit for its wires in certain streets of that city.

TELEPHONE INCORPORATIONS.

The Home Telephone Company. Rossville. Ind. Capital stock, $2,500.

The Mutual United Telephone Company, Clinton, Mo., Capital stock, $15,000. Incorporators: G. R Lingle, S. T. Neill, W. F. Hall and others.

The Rockford Home Telephone Company, Rockford, Ill. Capital stock, $200,000. Incorporators: George F. Wilson, Frank M. Puffer and George F. Miner.

The Lost Nation & Keystone Telephone Company, Dubuque, Ia. Capital stock, $1,000, Incorporators: L. W. Crane, Dan Kommer, H. C. Borgert, E. B. Read, L. Schultz and Freeman Current.

The Eastern Massachusetts Telephone & Telegraph Company, Jersey City, N. J. Capital stock, $25,000,000. Incorporators: Albert E. Bailey, Almon E. Carpenter and Washington Lithgow, all of 15 Exchange Place, Jersey City.

GENERAL ELECTRICAL NEWS.

Lighting.

Aguas Calientes, Mex.—An electric light plant will be established here, under contract to furnish the necessary lights for public purposes.

Altamont, Ill.—The city has awarded the contract to build an electric light plant to T. C. Reed of Chicago, the cost not to exceed $12,875.

Berlin, Pa.—The electric light plant here has been purchased by C. P. Shupe, a Mt. Pleasant capitalist. The price was $5,400, and the plant will be improved.

Butte City, Mont.—This city is to have a new electric light company, Pat Mullins, George H. Casey and others having applied for a franchise.

Chadwick, Ill.—The village council has purchased the Frank Zinnell electric light plant, and this place will be lighted by the municipality.

Colorado Springs, Col.—Extensive repairs are being made by the Manitou Electric Company at its plant in this city. Before the first of October it will be able to furnish both light and power day and night. Dr. Bell, who controls the company, will spend about $10,000 before the alterations are completed.

Delmar, Del.—A committee has been appointed at this place to ascertain whether the town can afford electric lights.

Flora, Ill.—The city council recently voted to expend $4,000 on the electric light plant, increasing the capacity one-half.

Fortville, Ind.—The town council has closed a contract with I. N. Stabler of Fairmount giving him a 25-year contract for an electric light plant.

Greenwood, Miss.—C. E. Wright has received a franchise for the construction of a sewerage system, waterworks and electric light plant.

Hempstead, Tex.—Parties are in the city making arrangements to establish an electric light plant.

Kahoka, Mo.—Work will soon begin on the new electric light plant to be owned and operated by the city.

McKeesport, Pa.—The citizens will have an opportunity to decide whether or not the city shall erect an electric light plant, providing the ordinance authorizing the election for a bond issue passes both branches of council.

Mellette, S. D.—This place will have a new electric light plant. Address Carl Gregory.

Morgantown, W. Va.—The Morgantown Electric Light & Power Company has sold its plant and franchise to a syndicate of citizens composed of L.O. White, R. D. Herschman, Frank Cox, W.E. Glasscock, Joseph H. McDermott and R. E. East for $40,000. The plant will be enlarged and an electric railroad is in consideration.

Newberry, Mich.—This village is agitating the question of an electric light plant and water system.

Paris, Ky.—The Paris Electric Light Company, with a capital stock of $30,000, has been formed here.

Pawnee, Mo.—The citizens insist that electric lights are necessary in this town.

Redfield, S. D.—The building for the new electric light plant is about completed, and the machinery will soon be placed in position.

Terry, Miss.—The mayor and board of aldermen has ordered an election to be held October 7 to vote on the question of issuing bonds to put in waterworks and an electric light plant.

Topeka, Kan.—T. W. Roby, of Amherst, N. H., will build an opposition electric light plant in this city, costing $100,000.

Walhalla, N. D.—This place will have its electric light system installed in a few weeks.

Manufacturing.

East Liverpool, O.—The Electrical Porcelain Company has been organized here with $30,000 capital and applied for incorporation papers. It will erect a pottery for the manufacture of supplies used by electrical companies. The incorporators are: William Erlanger, Sr., William Erlanger, Jr., S. C. Dyke, Harry Peach and R. J. Marshall.

New York City.—The Rapid Transit Subway Construction Company has awarded to the Allis Chalmers Company a contract for the construction of eight 5,500 horse power stationary engines, and to the Babcock & Wilcox Company an order has been given for 48 boilers of 600 hp. each. A contract aggregating $1,500,000 will be let for electrical apparatus to be used in the third-rail system.

Princeton, N. J.—The Central Electric & Construction Company, composed of Princeton capitalists, was lately incorporated by Charles P. Fitch, William W. Parsons and George B. Parsons. The company proposes to carry on an electrical business and manufacture electrical appliances. It will also engage in the electrical engineering business. The principal office is at No. 9 Chambers street, this city.

St. Louis, Mo.—Notice of an increase in its capital stock from $75,000 to $300,000 has been filed by the Emerson Electric Manufacturing Company.

Street Railways.

Aylmer, Ont.—Recently it was announced that the Hull & Aylmer Electric Railway had been sold to Mr. Beemer, or interests represented by him. This sale is a fact. The price agreed upon for the line and entire property and assets is nominally $1,200,000.

Baltimore, Md.—The Garrett Water & Light Company, capital $100,000, has applied for a charter, and wants to operate at Mountain Lake Park and Loch Lynn Heights, and to build an electric road between Deer Park and Oakland. George C. Sturgis, Morgantown, W. Va.; F. T. Martin, Fairmont, W. Va.; F. A. Thayer, Oakland, Md.; L. A. Rudsill and P. T. Garthright, Mountain Lake Park, are interested in the enterprise.

Benton Harbor, Mich.—Early this spring the Michigan & West Shore Traction Company secured a franchise along certain streets in this place. S. B. Downer, one of the stockholders in the company, filed articles of incorporation. The capital stock will be $1,350,000. Mr. Downer also filed a mortgage, payable to the American Trust Company of New York, for $1,350,000, which amount will be used to construct, maintain and equip a new electric system. The Michigan & West Shore Traction Company will build and operate an electric railway from South Haven, through Covert, with a loop around Paw Paw Lake, through Watervliet, Coloma and Riverside, terminating at Benton Harbor.

Broadwell, Ill.—W. H. Price will make application for a franchise for the construction and operation of an electric railway through certain streets in this town.

Buffalo, N. Y.—The Buffalo, Lockport & Olcott trolley line is being equipped with a new feature in the line of freight cars.—Loren M. Hewitt, receiver for the Buffalo, Hamburg & Aurora Electric Railway, has secured an order from the Supreme Court requiring the Security Safe Deposit Company to hand over the books of the road.

Hibbing, Minn.—On the lower level of the Rust Mine, 180 feet below the surface, there is in the course of construction an electric trolley line or haulage system, that will be used for tramming ore to the Skip Road.

Keyport, N. J.—The Keyport Trolley Company has been granted a franchise in Matawan township, and will extend the trolley service through that township toward Freehold, and also toward South Amboy. These extensions must be completed within 18 months, or the franchise becomes void.

La Grange, Mo.—A move is on foot for the construction of an electric line from either this place or Canton to Monticello, Williamstown, thence to Memphis and other towns in Scotland County.

Libertyville, Ill.—A franchise giving the Chicago & Milwaukee Electric Railway Company entrance into this place is assured. The company will build its branch from Lake Bluff this fall and next spring.

Poughkeepsie, N. Y.—A plan is under way, though not yet thoroughly matured, to build a trolley road between this village and Peekskill.

Sandwich, Ont.—The town council has granted a franchise to the South Essex Electric Railway.

Seattle, Wash.—The Cascade division of the Great Northern is to be equipped with electric motors for the operation of trains instead of steam locomotives.

Shoals, Ind.—The Shoals Coal & Mining Company, with a capitalized stock of $150,000, has been organized by a number of well-known men, and 2,000 acres of land have been leased in this vicinity. Mining for coal will be entered upon on an extensive scale. An electric tramway has been ordered constructed across White River, connecting the point where the bins are to be located with the Baltimore & Ohio South Western Railway.

Whippany, N. J.—The plan of the Northern Counties Electric Railroad Company, which is being promoted by H. C. Reynolds, of this place, is to build an interurban, high speed, electric railroad across the northern counties of the State of New Jersey, to carry freight and express as well as people.

Company Matters.

Bloomington, Ind.—The People's Gas, Electric & Heating Company of this place has filed a notice of increase of capital from $35,000 to $150,000.

Charlotte, N. C.—The property of the Catawba Electric Power Company was sold last week at public auction at Dallas, N. C. In the sale were included the Mountain Island Cotton Mill, 1,100 acres of land, and fine water power.

Darlington, Wis.—The Darlington Electric Light & Water Power Company is now engaged in installing machinery for making pearl buttons.

Reinbeck, Ia.—The Eagle Grove Electric Company has made an assignment to James Porter of this place.

Utica, N. Y.—The Utica Electric Light & Power Company has perfected plans for a complete underground system of wiring in the subway district.

Warren, O.—The Colonial Electric Company, composed of Warren and Youngstown men, and which has a plant in Ravenna, lately elected directors as follows: T. H. Gillmer, E. W. Gillmer, E. E. Nash, W. C. Ward and E. E. Roberts. There will be no change of officers.

Power and Transmission.

Petersburg, Va.—Extensive electrical improvements will be made here by the Southside Railway & Development Company. The purpose of the company now is to utilize all the water power of the Appomattox River in this city, converting it into electricity, which is to be employed for light and power. By the franchise, this company now owns the river beyond Farmville, the privilege being granted to it by charter of constructing a 40-foot canal. It is believed that work will begin soon after the first of the coming year.

Salt Lake City, Utah.—This State is to have another big electric power plant. The manager of the enterprise is W. C. Weaver, receiver of the Bear River Irrigation Company, and his associates comprise New York, Chicago and Salt Lake City capitalists. The power house of the new company will be built just south of Collinston in Box Elder County. It is the intention to erect a plant that will generate 5,000 hp. of electricity.

Automobiles.

Chillicothe, O.—B. A. Gramm has organized the Motor Storage & Repair Company, of which he is general manager, and has let the contract for a building for a stable and repair shop for motor carriages run either by steam, gasoline or electricity.

Milwaukee, Wis.—The Milwaukee Automobile & Brass Specialty Company is the name of a new concern recently incorporated and capitalized at $15,000. The stockholders are William Spence, Geo. A. Rosenbauer and Frederick Bergman.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, September 16, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	34	37
Broadway and Seventh Avenue	100	246	246
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	164	164¼
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	221	221½
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	106	107
Brooklyn City Railway	100	242	244
Brooklyn Rapid Transit	100	66	66¼
Baltimore United Railways, com	50	16½	16¾
do. do. do. pref	50	91	92
Buffalo Railway	100	110	111
Cleveland City Railway	100	120	121
Cleveland Electric Railway	100	87½	88⅝
Columbus (O.) Street Railway	100	47	50
Jersey City, Hoboken and Paterson	100	20	23
New Orleans City Railway, com	100	29	31
do. do. do. do. pref	100	101	105
North Jersey Street Railway	100	22	26
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	31	32
do. do. do. pref	100	86	87
St. Louis United Railways, com	100	26¾	27½
do. do. do. pref	100	89¾	90
Detroit United Railway	100	74⅞	75¼
PHILADELPHIA.			
American Railways	50	40¼	40½
Citizens	50	353½	354
Columbus Railway	100	40	40½
Columbus Railway, pref	100	84½	85
Consolidated Traction of New Jersey	100	68	69
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	24	24½
do do pref	50	60	60½
Dayton Traction	100	50¼	50¾
Fairmount Park and Haddington	50	75	75½
Fairmount Park Transportation	50	26	26½
Frankford & Southwark	50	450	450½
Germantown	50	147½	148
Green & Coates, $15 paid	50	155	155¼
Hestonville Mantua & Fairmount	50	47	47½
do pref	50	73½	74
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	43	43½
Newark, N. J.	100		
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	104	104½
Philadelphia Traction	50	97½	98
Railways Company General	5	2⅛	2⅝
Reading Traction	50	32¼	32½
Ridge Avenue, $28 paid	50	308½	309
Rochester	100	25	25½
Scranton and Carbondale	100	19¼	19¾
Second & Third	50	302½	303
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	311	311½
Trenton Street Railway	50		
Union $30 5-6 paid	50	235	235½
Union Traction, $17.50 paid	50	27½	28
United Power and Transportation, $29 paid	25	45	45½
United Traction of Pittsburg	50	14	14½
do do pref	50	30	30½
United Traction of Reading, Pa	50		
West Philadelphia	50	255	255½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	178½	179
West End Street, com	50	96	96½
do. do. do. pref	50	112	113
CHICAGO.			
City Railway	100	205	210
Lake Street Elevated	100	13	13¼
North Chicago	100	190	200
Union Traction, com	100	16¼	18
do. do. pref	100	58	60

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	22	22½
do. do. do. pref	50	95¼	94½
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	49	50

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Electric Boat, com	100	16	20
do do pref	100	48	49
Electric Lead Reduction	100	2¼	2⅝
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	5½	6½
do do pref	100	8½	11
General Carriage	100	½	1
General Electric	100	260	260¼
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	250	251
General Electric	100	259	259¼
Massachusetts Electric Companies, com	100	36	39
" " " pref	100	93	93½
Westinghouse Electric & Mfg., com	50	72	72¼
do do do pref	50	80	80½
CHICAGO.			
Chicago Edison	100	167½	167¾
National Carbon, com	100	18	18⅝
do do pref	100	85	85½
PHILADELPHIA.			
Electric Company of America	50	7¼	7⅝
Electric Storage Battery, com	100	71	72
do do do pref	100	85	86
General Electric Automobile	50	¼	⅝
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	5⅝	5¾
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	93	94
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
BOSTON.			
American Telephone & Telegraph Company	100	164¾	165*
Erie Telegraph & Telephone Company	100	36	36¼
New England Telephone Company		135	135¼
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co.	100	105	110
Commercial Cable Company	100	180	185
Franklin Telegraph Company	100	42	50
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	116	118
Mexican Telephone Company	100	2	2½
New York & New Jersey Telephone Company	100	168	178
Pacific & Atlantic Telegraph	25	70	75
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	
Western Union Telegraph Company		91¾	92
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	116
Cumberland Telephone & Telegraph Co	50	136	140
Chesapeake & Potomac Telephone Company	100	67	70
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		75	76
Hudson River Telephone Company	100	120	125
Northwestern Telephone Company, guar	50	122	126
Providence (R. I) Telephone Company	50	96	97
Southern New England Telephone Company	100	..	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Sept. 16.

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1⅛	1⅝
Eddy Electric Manufacturing Company	25	10	10¼
Storey General Electric	10	11	12
Consolidated Car Heating	100	55	58
Standard Underground Cable	100	218	220
Pratt and Whitney, pref	100	87	88

STREET RAILWAY BONDS.

ALBANY.	Last Sale.	Int. Paid.
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent.	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105⅜	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907	115⅝	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅝@16¾c.; Lake, 16¾@17c.; casting, 16½@16¾c.

Advices from London indicate that the inflow of gold from Europe is about to begin.

The General Electric Company has declared the regular quarterly dividend of 2 per cent. on the common stock, payable October 15.

New York Manhattan Elevated stockholders will hold their annual meeting November 13; books close October 11 and reopen November 14.

The Kensington Electric stock, giving the Philadelphia Electric Company practically complete ownership in the former company, has now been paid for.

The American Railways Company inspection party decided to double the capacity of the power house at Springfield, O., and to make extensions to the road.

New York interests in the Chicago Union Traction Company say, with respect to the resumption of dividends, that the matter has not been taken up by the board of directors as yet.

Directors of the United Traction and Electric Company of New Jersey have declared the usual quarterly dividend of 1 per cent., payable October 1; books closed September 17 and reopen October 2.

In order to meet the competition of the street electrics the Boston and Albany Railroad Company has reduced its local rates from South Framingham to Milford, 12 miles, to 10 cents, the former rate being 27 cents. The electric fare is now 15 cents between these points.

The stockholders of the North and East River Railway Company, Fulton Street Railroad Company, and the Thirty-fourth Street Cross-Town Railway Company, will hold their annual meetings in this city on October 1, and the Central Park, North and East River Railroad Company on October 15.

The United Traction Company of Albany, N. Y., did particularly well during July and August this year, the net profits of the two months amounting to $61,423. In other words, the net returns of the company for the two-mid-summer months were equal to a dividend of nearly 1¼ per cent. on the company's stock.

The board of directors of the New Orleans City Railroad Company have agreed to accept the offer of H. H. Pearson, Jr., acting for Brown & Co. of Philadelphia, and representing Philadelphia capitalists, for the lease or purchase of their lines, thirteen in number, and to recommend the stockholders to accept the offer.

An officer of the Electric Storage Battery Company is authority for the statement that the business for the first half of the current year has exceeded the same period of 1900 and the dividends are being more than earned. Dividends were commenced last December, and the next quarterly dividend will be payable about October 1.

J. M. Thomas, president of the Telephone, Telegraph and Cable Company of America, says that 245,000 shares of the outstanding capital stock have been deposited with the City Trust Company of New York in accordance with the offer of C. W. Morse. The deposit represents over $2,000,000, more than sufficient to put the terms of Mr. Morse's offer in effectual operation.

The joint agreement of consolidation made on September 9 between the Golden's Bridge Electric Railway Company, of Westchester County, New York, and the Danbury and Golden's Bridge Street Railway Company, of Danbury, Fairfield County, Connecticut, was filed with the Secretary of State at Albany on Monday. When constructed the lines of the consolidated company shall form a continuous railroad from a point near the New York, New Haven & Hartford Railroad, on White street, in Danbury, to Golden's Bridge, on the Harlem Railroad, in Lewisboro, Westchester County, by means of the Danbury and Golden's Bridge road. The capital is $300,000.

According to the annual report of the Metropolitan Street Railway Company of New York for the year ended June 30, 1901, furnished to the Railroad Commissioners at Albany Saturday, the gross earnings were $14,063,781.92, against $13,785,083.94 in the year ended June 30, 1900, and the operating expenses were $6,755,130.94 and $6,631,253.66 respectively. The net income was $3,431,567.39 in 1901 and $3,360,159.54 in 1900. Dividends were declared of $3,393,262.25, against $3,145,891 in the previous year, leaving a surplus over dividends of $38,305.14 in 1901 and $214,268.54 in 1900. Full effect of the economies resulting from the conversion from cable to electric traction will only become apparent during the current year. This alteration accounts for the increased cost of operation. During the last half of the year covered by the report dividends were paid on $52,000,000, instead of $45,000,000, as formerly.

A committee, consisting of George W. Young, John Crosby, James Timpson, W. H. Hollister and J. H. Lane have prepared a plan for the reorganization of the Washington (D. C.) Traction Company. It provides for a foreclosure of the first collateral trust mortgage and a transfer of the property to a new company or to the Washington and Great Falls Electric Company. It is provided that the successor company shall authorize the issue of $17,000,000 fifty-year mortgage 4 per cent. gold bonds and $6,500,000 common stock. Assenting security-holders will receive for each $1,000 bond $550 new 4s, $550 new preferred, $200 new common; for each $100 share of stock on payment of $9, $9 new preferred stock, $30 new common stock An agreement has been made by which $672,000 in bonds of the new company are to be purchased by a syndicate, depositing bondholders to be allowed to participate in such purchase at the same rate, viz., upon payment of $50 for each bond deposited the depositing bondholder will receive $50 in bonds and $25 in common stock of the new company.

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EDITORIAL NOTES.

Underground Electric Lines of London.

After prolonged deliberations, doubtless somewhat delayed because of the troubles which have arisen on the Central London Railway through vibration, the contract for the electrical equipment of the Great Northern & City Railway of London has been settled. It has gone to the British Thomson-Houston Company, but the figure is not stated. Originally it was intended to employ electric locomotives larger than those used on the Central London, but subsequent events have naturally led to drastic alterations in those plans. The British Thomson-Houston "train control system" will be adopted entirely, and this for the first time on an electric line in that country. A three minute service will be maintained on this seven-mile line, the journey from localities known as Finsbury Park to Moorgate street occupying 13½ minutes. Each train is to weigh about 200 tons. In this connection it is interesting to note that the electric locomotive which is being experimented with on the Central London Railway only weighs 31 tons as compared with 42 tons, which is the weight of those now running. A multiple unit train is also running as an experiment.

The Great Northern & City will have a third rail of 80 lbs. Channel section. Copper plastic bonds, also double petticoat porcelain insulators to support the rails are specified. The collector rails of both tracks will be interconnected at intervals, and an automatic circuit breaker in each circuit will enable either rail to be isolated from the other when required.

The power station equipment will comprise four 1875 IHP. engines (vertical cross compound condensing) running at 100 revs. per minute. An 800 kw. railway generator (14 poles, 100 revs.) will be mounted on the main crank-shaft between the engines. Smaller auxiliary sets of 50 kw. capacity at 400 revs. will supply light and power for the stations and repair tools at night. Four surface condensers, Hunt gravity bucket coal conveying plant, a 30-ton three-motor electric traveler, and a 16-panel main switchboard with magnetic blow out circuit breakers, and instruments, are features of the undertaking. There will be 36 motor cars. Each will be mounted on two four-wheel trucks, each carrying one Thomson-Houston G. E. 66 geared motor. Each car will have four collector shoes, and Christensen brake equipment.

In regard to the electrification of the Metropolitan and District lines a joint meeting of all parties concerned was held at the Board of Trade on August 29. Messrs. Yerkes and Perks were present, and Mr. Blathy appeared on behalf of the Ganz system which Mr. Yerkes has been to Buda Pesth to investigate. Little is known by the public as to what transpired, but it is hinted that one of the parties is even now unable to make up its mind as to the electrical system which should be adopted.

* * *

Proposed Water Power Developments in the Alps

A number of circumstances have recently directed the attention of France more than ever before to the utilization of water power for driving machinery. The country is said to have been suffering from the coal crisis, which a year ago caused a serious advance in the price of this fuel, and while steam coal was becoming more expensive the need for it was greater than ever, owing to activity in the metallurgic industries and in railroad building. France is compelled to buy large quantities of coal on account of her insufficient home supply. One of the foremost questions now before the country is the substitution of water power in the Alps for a good deal of the coal now consumed in French factories.

The Alpine region of France is about as large as that of Switzerland, Lombardy and Piedmont together. This fact is not widely recognized. The mountains of southeastern France on the whole are by no means so imposing as the Swiss and Italian Alps, but they cover more ground. The population of France's Alpine districts is much less than that of the neighboring mountain regions, and this is one of the reasons why Switzerland and Italy have far surpassed France in the utilization of mountain streams for power purposes.

The Annales de Géographie announced not long ago that there are now in the French Alps forty-eight factories whose power is electrically supplied to them from mountain streams. These factories have 250,000 horse power brought to them by electricity generated from water power. Engineers estimate that at least 3,000,000 horse power is now running to waste among the streams of the Alps which might be harnessed in the service of many industries and thus reduce the importation of coal.

France takes high rank in the production of electrical machinery and thus may supply her own appliances for the transmission of water power. Several important projects are now under way. Work is in progress for the development of 10,000 horse power near Bellegarde. A French engineer named Souleyre proposes to transform the lower Rhone into a "gigantic hydraulic stairway" by which industry and agriculture will largely profit. A committee of engineers appointed by the Minister of Public Works and Agriculture is studying the project with a view to deciding upon its feasibility.

* * *

Some Statistics as to the Cost of City Lighting.

Some statistics are at hand as to the cost of lighting the principal cities of the United States, which are extremely interesting. Chicago spends $600,000 a year in street lighting; Boston, $650,000; Cincinnati, $425,000; Baltimore, $350,000; San Francisco, $245,000; Providence, $250,000; New Orleans, $230,000; Cleveland, $325,000, and Washington, a city of long distances, low houses and wide streets, $235,000. New York will expend for street lighting in 1901 $2,745,000 for gas and electricity. Of this total Manhattan uses $960,000; Brooklyn, $950,000; the Bronx, $350,000; Queens, $355,000, and Richmond, $130,000.

By comparison with the expenditures of other American cities for illumination, says a daily paper, New York's annual payment may seem to be abnormally high, but there are various reasons why the cost of public lighting should be proportionately much larger here than elsewhere. New York has a larger water front than any other American city. While other cities have usually one public market, New York has a dozen, and the eight included within the borough of Manhattan use on an average 5,000,000 cubic feet of gas in a year. Many other American cities rent the premises they require for public departments, whereas New York owns most of her public buildings, and the gas bills, which in some instances are met by private individuals, are in most cases here paid directly from the appropriation, which, while nominally for street lighting, actually includes all forms of illumination for which the city is responsible.

New York has in all nearly 60,000 lamps, gas and electric. There are 30,000 in New York and the Bronx, of which 24,286 are gas lamps, 4,538 electric, and the others naphtha lamps. Brooklyn has 11,015 gas lamps and 4,603 electric lamps. Queens borough, the most extensive division of New York to be lighted, has 3,839 gas lamps and 2,106 electric lamps. Richmond, the most progressive of the boroughs of New York in this particular, has all electric lights—no gas. Of these, 2,883 are incandescent lamps and 382 are arc light. There are, moreover, 100 oil lamps in use in the borough of Richmond.

The extent of the territory to be covered and the peculiar conditions existing in New York explain to a great extent the reasons for so large an appropriation for illumination, nearly 3 per cent. of the entire budget of the city, which is $100,000,000 for next year.

The Export of Electrical Apparatus from New York.

The Treasury Department has instructed the collector of customs at New York to allow, on the exportation of certain electrical apparatus, such as generators, motors, alternators, commutators, armatures and rheostats, in the manufacture of which no other than imported unmanufactured or rough-trimmed mica has been used for insulating purposes; also on the exportation of mica manufactured into sheets, plates or other forms, wholly from the same description of imported mica, for use in foreign countries as electrical supplies, a drawback equal in amount to the duty paid on such imported material used, less the legal deduction of 1 per cent.

The drawback entry must show, separately, the marks and numbers of the shipping packages, the name of the apparatus contained therein, the name, location, form and dimensions of each mica part, the number of such parts in each apparatus, the total weight of mica appearing therein, the percentage to be added thereto to compensate for loss in manufacture, and the total weight of mica in condition as imported consumed in the manufacture.

When mica manufactured into sheets, plates, or other forms is exported, the entry must show, in addition to the marks and numbers of the packages, the gross and net weight of the same, which must also be marked or stenciled on the outside of each package.

The said entry must further show, in addition to the usual averments, that the several mica parts or forms of electrical supplies described therein were manufactured of material and in the manner set forth in the manufacturer's sworn statement.

In liquidation the quantity of mica in condition as imported, which may be taken as a basis for allowance of drawback, may equal the quantity declared in the drawback entry, officially verified, but in no case shall the allowance exceed 1 pound for every 10 cubic inches of mica consumed in the manufacture, nor shall the percentages to be added to the weight of the exported mica, or mica parts, to compensate for waste incurred in the manufacturing processes.

Samples of the different forms of mica may be taken, or sworn samples of the same and of the mica parts appearing in the exported apparatus, may be furnished, as ordered by the collector, for such determinations as may be considered requisite.

A SHORT note in "La Genie Civile" of Paris describes a machine for increasing the proportion of oxygen in the air before using it in furnaces. The machine is said to be due to M. Mazza, an Italian engineer, and is merely a centrifugal separator. On passing air into this centrifugal machine, the oxygen molecules, being heavier than the nitrogen ones, tend, it is stated, to concentrate at the periphery of the machine, and on drawing off the air at this surface it is found to be considerably richer in oxygen than normal air. In fact, the oxygen contents can, it is said, be readily brought up to 26 per cent. of the total (weight?). Common air, it will be remembered, contains but 23.2 parts by weight of oxygen. The centrifugal machine used acts at the same time as a blowing fan, the enriched air being delivered under a slight pressure, whilst the impoverished air is drawn off continuously from near the center of the machine. About two horse-power are needed, it is stated, to operate a separator capable of delivering 18,000 cubic feet of enriched air per hour. This enriched air has been used for supplying the furnaces of a boiler, and has led, it is stated, to an increase of water evaporated per lbs. of coal from 9.5 lbs. with natural draught to over 12 lbs. with the Mazza apparatus.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

THE Old Time Telegraphers have selected Salt Lake City, Utah, for their meeting place for 1902.

SWEDEN is likely soon to supplant steam with electricity as a motive power for the railroads of the country. Electricity will be generated by the numerous waterfalls and cascades which abound there.

A CERTAIN well-known electrical manufacturing concern in this country is said to have adopted a most effective method of stamping out anarchy. The plan is to discharge from employment every man who speaks disparagingly of the late President McKinley and his assassination and every employe who has anarchistic ideas. The business men think that when the daily bread is taken from these creatures they may ultimately reform to decent, law-abiding citizens.

YEIGE NAKAJIMA, chief engineer of the city of Tokio, Japan, has lately been in Cincinnati, O., to study the double trolley system and the electrolysis of water and gas mains, and was well satisfied with the knowledge gained from statistics and photographs.

IN an experiment in canal towing about to be tried in London the canal barges will be drawn by an electrically propelled vehicle using the tow path and fed by an overhead trolley also.

UNDER a recent decision of the Swiss customs department incandescent lamps for electric lighting are dutiable at $4.825 per 100 kilogs. The following are to be included under the heading "electric lamps" subject to duty at the rate of $1.158 per 100 kilogs. Arc lamps with or without lamp holders: glass globes for arc lamps; commutators of all kinds; cut outs, mounted on stone, slate or porcelain; resistances for arc lamps with or without regulating appliances; hand or automatic regulators; fittings for incandescent lamps; current recorders; current direction indicators, etc.

IN a recent patent, Mr. B. G. Lamme takes up the subject of armature winding for alternating current generators. The object is to provide a generator which shall have certain advantages over those heretofore designed and employed in similar relations. Among such advantages, comments the "Electrical Engineer" London, are the utilization of an armature with a large number of slots and a small number or conductors per circuit: one which may have as many circuits in parallel as desired without regard to the number of field-magnet poles; one in which each circuit is uniformly distributed entirely around the armature periphery; one in which the coils are so constructed and arranged that in case of accident to any winding the remaining windings will be uniformly distributed, and may therefore be used satisfactorily; one in which the windings may be used independently for separate circuits if desired; one in which part of the windings may be reversed when the number of circuits is an odd number, so as to provide a symmetrical arrangement, and one in which the difference of potential between adjacent end conductors is less than that between the end conductors of any one of the windings that are nearest to each other.

A PARIS dispatch to the N. Y. "Herald" says the Academy of Sciences has heard a report on a telegraphic invention recently made by M. Mercadier, of l'Ecole Polytechnique. It combines a multiple with the Baudot apparatus, so as to enable sixteen operators to work simultaneously on the same circuit.

CHARLES T. YERKES' determination to charge a uniform fare of five cents on the London underground railroad, instead of fares from a shilling downward, working the road on American principles, will be thought, London "Engineering" says, absolute nonsense by nearly every English railroad man. "If the road is expected to pay, Mr. Yerkes," the paper says, "will give Englishmen an object-lesson in three principles—rapid transit, cheap fares and frequent services."

A REPRESENTATIVE of the Marconi wireless telegraphy system has arrived at St. John's, N. F., to open a station on Cape Race. He hopes from the general outline of the land to send messages 160 miles to sea. This will be the first station operated in the colony of Newfoundland.

RELIEF from the discomforts of the New York Central tunnel is at last assured, and if promises made last week to the board of health are kept, plans for admitting light and air into the Park avenue dungeon will be filed within a fortnight. Abatement of the smoke nuisance will be accomplished by increasing the number and size of the street openings and by tearing down the walls which separate the side tunnels from the middle section. Eventually electricity will be substituted for steam as the motive power of suburban passenger trains.

AN ingenious time-saving appliance for transshipping mails and baggage in connection with the cross Channel service has been brought into operation at Dover, says "Electricity," London. The appliance is in the form of an endless traveling platform, and is worked by electricity. It brings packages of any weight ashore at the rate of 1 in 15 seconds. Some of the packages unloaded recently weighed 7 cwt., and required four men to lift them, but they were brought ashore as easily as a hand-bag. The trans-shipment was performed in less than half the usual time.

THE Big Consolidated Railway Company of Cleveland, O., has recently installed a storage battery in its Cedar avenue power-house, which is at work absorbing any surplus current which may be generated and not be needed for immediate consumption. With the storage battery in operation waste of current is impossible, for by its use every surplus bit of current is captured and stored away until a breakdown of an engine or a sudden increase in traffic demands its release. Enough power can be stored in the new battery to run the entire Big Consolidated system for several hours, and as it would take quite a serious accident to derange the system for that length of time, a tie up of the lines is practically impossible.

AN ingenious device which measures the actual time a telephone has been in use, so that the company may charge the subscriber only for the actual service he has had, is the subject of a patent lately granted to Mr. Thomas Baret, of Sydney, New South Wales, according to the London "Electrical Engineer." The idea is that a subscriber who has but little use for his telephone will not be compelled to pay the same as one whose instrument is in fairly constant use. To this end the lever switch of the telephone is connected with the clock or other mechanism, which shall be inoperative when the telephone is not in use; but as soon as the receiver is lifted from the hook the clockwork shall commence to operate, and will thus register the extent of time that the instrument has been working. The apparatus is so arranged that the up-and-down movement of the lever switch shall wind up the clockwork, and thus the operation will be almost entirely automatic. A dial is provided for indicating the length of time the telephone has been in use.

Resolutions by Electrical Exhibitors.

The Electricity Building exhibitors at the Pan-American; have adopted the following memorial upon the death of President McKinley:

Whereas, William McKinley, our beloved and universally respected President, has been removed from our midst by the hands of an assassin; therefore be it

Resolved, That we, the representatives of the Pan-American electrical exhibitors, do hereby signify our great sorrow at the loss of the man so eminent as a statesman, soldier and scholar;

Resolved, That William McKinley shall ever stand in our memory as an example of the highest type of a Christian gentleman and as an upright and unimpeachable President of the United States.

Resolved, That our earnest and heartfelt sympathy be extended to Mrs. McKinley in her loss of a true and loving husband.

Resolved, That these resolutions be forwarded to the Associated Press of the United States and entered upon the minutes of our meeting of September 17, 1901.

English Electricians Cable Condolence.

Secretary Pope of the American Institute of Electrical Engineers has received the following cablegram from the President of the Institution of Electrical Engineers of Great Britain:

London, Sept. 19, 1901.

President, American Institute of Electrical Engineers.

Members Institution Electrical Engineers, London, tender sympathy for yourselves and American Nation in sad death of President McKinley.

(Signed) LANGDON, President.

Proposals Invited.

Sealed proposals are being invited until October 16 for furnishing and installing electric elevators in the new building for the Government Printing Office, Washington, D. C. Drawings and blank forms of proposal will be furnished intending bidders upon application to Capt. John S. Sewell, United States Engineers' Office, Washington, D. C.

MISCELLANEOUS NOTES OF INTEREST TO CENTRAL STATION MEN.—VI.

BY W. H. WAKEMAN.

As long as the fly balls on the governor of a Corliss engine revolve in a given plane it is possible to vary the speed of the engine by changing the length of the small rods which connect the governor to the tripping device, which indicates where the cut off shall take place. It is not advisable to do this, however because there is danger of making the shortest cut off that can be obtained with the new adjustment, so long that if all of the load was suddenly thrown off by the breaking of the main belt, or throwing all of the switches out on an electric circuit, the engine would "run away" even with the balls in their highest position. If the length of these small rods is changed for any purpose whatever, the engine should be tested by getting up the highest allowable boiler pressure, throwing off all of the load and noting the effect.

If the speed is greater than it is with an ordinary load the cause of it should be found and removed. Sometimes the collar above the center weight on a governor is set too low, in which case it should be moved enough to allow a cut off that will prevent racing. It is dangerous to omit this test.

A young man secured a position as assistant engineer in an electric station. The manager asked the chief engineer if the engines could be speeded up three or four revolutions per minute without changing the governor pulleys, and was informed that it could not be done. During the absence of the chief the manager asked the assistant the same question and was informed that it could be done, and that he could do it. He proceeded to change the governor rods so as to give a longer point of cut off, and as the governor could not shorten it as before, he gained three revolutions. When the matter was reported to the chief engineer he discharged the assistant, and in my opinion he did just right.

My reasons for this opinion are as follows: On general principles an assistant engineer should run the machinery placed in his charge during his shift, but not make any changes in it while the chief is absent, as said chief is responsible for the whole plant.

In this case the assistant not only violated the above principle, but made a change that was decidedly dangerous, for if all of the load had been suddenly thrown off, the governor could not have controlled the speed. This defect would have been charged to the chief and not to the assistant, therefore only those assistants who know their place are entitled to work in such plants.

Our boiler glass gauges, as well as those on our lubricators frequently become so foul that their usefulness is much impaired, if not entirely destroyed, and unless great care is exercised when cleaning them they are broken. An iron rod should not be used to push a piece of waste through one of these glasses, as it is usually broken by such means, but if a piece of wood is used there is much less danger of breaking the glass. If the sight feed glass on a lubricator is filled with glycerine instead of water it will be much easier to keep it clean.

Some time ago I saw a lubricator that had evidently caused the engineer some trouble, for he had given up trying to use a glass gauge on it, and had put a piece of gas pipe in its place. By opening the regulator valve a certain distance, he claimed to be able to regulate the feed just right, but such devices are not recommended.

Much time has been spent in attempts to demonstrate that if the pipe connections between a steam engine indicator and the cylinder to which it is attached are not straight and short, the resulting diagrams will not be reliable, but all of the engineers are not yet convinced, for some of them are satisfied to have two or three ells and several feet of pipe in use for this purpose.

If the pipes are of ample size and the speed of piston slow, it makes little difference, but slow traveling pistons are the exception rather than the rule at the present time. I made several experiments on the cylinder of one whose piston traveled 348 feet per minute, and here the usual connection by means of a side pipe with three way cock at the center, gave the same results as when the indicator was attached directly to the cylinder without even an ell between them. At another time I made a test on the same kind of an engine running 450 feet per minute, with two extra ells in the pipe connection. It showed that the valves were late and that there was but very little compression. When the indicator was attached close to the cylinder the diagram showed that no improvement could be made by changing the valves. Had they been changed so as to show a perfect diagram with the first connection used, they would in reality been far from right.

This demonstrates that it is always safe to attach an indicator directly to a steam cylinder without even an ell between them.

Great care should be taken when indicating an engine to have the reducing motion so arranged that the irregular motion of the cross head shall be accurately transmitted to the indicator.

It would take some space to explain mistakes that have been made along this line, but every one of them show lack of a due consideration of the subject from a mechanical poin of view. For illustration I might mention the case of a young engineer who attached his indicator and reducing wheel to his engine in the usual way, then carried the cord directly to the cross head without making any provision for a parallel motion of the cord, as it was about 8 inches nearer the piston rod at the cross head than it was at the indicator, the result of which was that the diagrams taken were not correct and the guide for the cord was cut in two in a short time by excessive friction.

As a rule when a steam fitter pipes up an engine for heating with exhaust steam, he puts a tee in the exhaust pipe with a back pressure valve above it. A branch pipe is screwed into the tee, followed by a valve that requires many turns of the wheel to open it. In one place I had a valve that required 31 turns to open or shut it.

How much better it is to put a cross valve in place of the tee, then screw the pipe into the valve. Such a valve usually requires about four turns of a wheel to open or shut it, making a convenient and neat arrangement.

One of the worst cases of a heating crank pin that I ever knew of was cured by setting the valves. Since then it has been my plan to look for the cause of heating crank pins at the opposite end of the machine, where it is often found.

Much remains to be learned by even the best informed engineers among us, therefore instead of being contented with our present attainments we should be constantly watching for some new kink or wrinkle that will be a help in our every day practice.

When an engineer becomes disgusted with his situation, and finds that he cannot change the obnoxious conditions, he will either become discouraged, neglect his work and so lose his place and take a worse one, or else he will make strong efforts to fit himself for a better one and then secure it somewhere. The latter plan requires more moral courage and strength of character, but is much the better to be adopted.

The old fashioned way of grinding in a brass globe valve is a slow and tedious process, therefore it seems much easier to allow it to leak steam than it is to repair it. Managers of steam plants that are fitted with this kind of valves will do well to adopt more improved methods for doing this disagreeable work, as it will prove a paying investment.

A valve seating machine of some kind will soon pay for itself where many valves are in use. Wherever a plant is fitted with valves from which the disks can be removed and others substituted at short notice, the engineer should always have a supply of these disks on hand for instant use. In some places the manager will get a few when told that they are wanted at once, but never will buy an extra one if he can help it.

Under such conditions engineers will postpone repairs as long as possible (for which they cannot be blamed), and this means that while they are waiting the owners are paying for steam wasted, etc. An evenly balanced consideration of this subject will convince anybody interested that it pays to supply such articles promptly.

If a leaky valve is located on the end of a pipe it is an easy matter to screw in a plug to stop it as a temporary relief. The only objection is that it frequently becomes a permanent fixture, and such makeshifts are a disgrace to any plant where they are found permanently.

Some engineers wipe their engines as soon as the run is finished, while others wait until just before another is started. If located in a mill or factory the engine is shut down at night and started the next morning by the same man. This leaves it optional with him to clean it up at night or in the morning.

Where a small station is run from 4 or 5 o'clock in the afternoon until early the next morning, the engineer has the same chance for choosing the time for cleaning. As a rule the engines that are cleaned as soon as the run is finished look the best because the oil and dust comes off easier then than they do after standing several hours.

A dirty, noisy engine does not speak well for the engineer in charge, but on the contrary it gives him a bad reputation, therefore he should give the matter all due attention. It is perfectly safe to say that a man who is contented to run an engine that shows by its general condition a lack of proper care so far as outward appearances are concerned, will not be as thorough about caring for the parts which are not so readily seen as he should be. There may be exceptions to this general rule but if so they are few and far between.

When an engineer is found that is able and willing to keep his machinery in good repair on both sides, namely, inside and outside, he should be paid a fair salary and kept at work. There is always somebody ready to take his situation at less wages, but in a majority of cases the owners of valuable machinery are too wise to make the doubtful experiment of changing engineers for such a consideration, especially if they are furnishing electric lights to the public, but occasionally a manager can be found who is foolish enough to do it.

The result of my observation is that if the new man is not competent he is not wanted, and if he is he soon wants his wages raised. These points should be taken into consideration before the change is made, for it is quite possible that the man who is offering to work at a low price will prove to be very costly in the end.

This is due to the fact that an engineer who is competent and contented can save his employer money in many ways, of which the incompetent knows nothing.

The mean effective pressure and the average pressure shown by an indicator diagram are never the same, and never can be except in the case of a condensing engine in the exhaust pipe of which there is a perfect vacuum, and that has never been attained. It is doubtful if it would pay to run an engine under such conditions, for the same reason that it does not pay to run a non-condensing automatic engine with a very short cut off.

THE EVOLUTION OF EXPOSITION LIGHTING.*

BY LUTHER STIERINGER.

The incandescent light has now disclosed its adaptability beyond any other light for exposition purposes. This broad statement is justified by the results finally attained at the present Pan-American Exposition.

The writer, having been identified with the first gas and electrically lighted expositions open at night, and most all of the prominent ones to date, either as designer and constructor, or as consulting engineer, has accumulated a complete library and data on this subject, from which the following is reviewed:

The history of the evolution of exposition lighting is a history of the many vagaries of practice that have finally led up to the use of the incandescent lamp as exemplified at the Trans-Mississippi and International Exposition in 1898, at Omaha, and on a larger scale at the Pan-American Exposition of to-day. It may not be amiss to briefly refer to the decorative illumination which antedates the time when electricity made the extensive illumination of large expositions possible.

The first festive illumination was practiced by the Chinese, who inclosed lights with fancy paper shades or lanterns. Architectural accentuation or outlining for festive occasions was originally done by candles or lanterns placed on window-sills or on the interior of windows. Candles were followed by gas jets placed close together to reignite when extinguished by air currents, or protected by colored globes. Tea store lighting in vertical lines by gas with inclosing glass globes (mostly in color) and also accentuation, festooning and outlining, succeeded the early illuminations by candles and lanterns.

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*Paper read at the 17th Annual Convention of the Association of Edison Illuminating Companies, Buffalo, N. Y., Sept. 10, 1901.

One of the first building exteriors to be decoratively lighted was the Turkish Pavilion at Manhattan Beach, L. I., in 1881, there being in use about 200 small gas jets inclosed in colored globes for the double purpose of protecting the jets against air currents, and also for the effect produced. The jets were electrically ignited. The lights were placed on the ribs of the dome of the pavilion about one foot apart. This pavilion had been at the Centennial Exposition in 1876, and was re-erected at Manhattan Beach in 1880. The first decorative outdoor electric illumination was on Elbridge T. Gerry's yacht "Electra" in 1883, which had 200 incandescent lamps hung in festoons between the masts, bowsprit and taffrail, outlining the upper rigging. These were placed about two feet apart, making a pleasing effect, and of a form now often seen on an elaborate scale on naval and marine festive occasions. The Paris Electrical Exposition of 1881 had electric lighting, principally by arcs and confined to the lighting of the building interior and several large incandescent lamp exhibits. In the United States the notable expositions about that period were two at Boston, one of which, the Mechanics' Fair, had 1,500 incandescent lights; for that period the largest plant in the world.

This was interior lighting. Following this, there was nothing of moment until the Vienna Exposition in 1883, which had mixed lighting. This same year a comprehensive electric light plant for an exposition was made by the installation at the Southern Exposition at Louisville, Kentucky, of 7,000 16 cp. incandescent lamps. The floor space lighted was 14 acres. This was the first exposition entirely lighted by incandescent light, and also the first to gradually bring the light up from nothing to full candlepower. This lighting was so satisfactory that it was re-installed in 1884; another exposition being held that year. It may be appreciated that in this instance there were 14 generators, running in parallel, serving 19 feeders. All the heavier lines were of bare copper.

In 1884, the Electrical Exposition under the auspices of the Franklin Institute took place at Philadelphia. At this exposition the commercial rivalry between competing companies led to a mixture of light that bordered on excessive display with one exception, which was the Pennsylvania Railroad station, which was lighted from the exposition by incandescent lights of 16 candle-power on a commercial basis to demonstrate the sufficiency and economy of incandescent illumination. Various expositions about this time, such as Cincinnati, Milwaukee and others, had partial electric light illumination, principally for art galleries. In 1884 the St. Louis Exposition was completed as a permanent annual exposition which has been kept up until the present. Its floor space is some five or more acres, and it contains a theater and one of the largest music halls in this country. The only electric company willing to undertake the lighting of this large building, proposed to do it with the incandescent lamp. It was awarded the contract for the entire building, requiring over 5,000 lamps. This is a notable installation from the fact that it was the first to have knife switches introduced. Many of these original switches are still in use. This was the first to have the wiring system of control and distribution, known familiarly and in use the world over—the cabinet system. The feeder lines were bare copper placed in capped moulding,—the wire coverers at that time being unable to cover heavy copper. This installation was until quite recently still intact. In a measure none of these expositions could be considered of magnitude. The World's Industrial and Cotton Exposition of New Orleans, in 1884 and 1885, continued the pace set by the Louisville Exposition by lighting all the interiors for visitors at night, and as much of the grounds as required for traffic. This being an International Exposition comprised many buildings, one of which (the largest yet erected) covered 34 acres, another 18 and in all 61 acres under cover, or the same floor space as the Centennial of 1876. This lighting was under contract under two systems, one of arc for general illumination, the other by 20,000 16 cp. incandescents placed in the most desirable sections, such as the mammoth music hall and art galleries. At this exposition the lights were under control from zero to full candle power as they were at Louisville in 1883. Nothing in the way of expositions demanding extensive illumination took place from this until the Paris Exposition of 1889. This being an extensive international exposition, demanded the careful consideration of the expediency of illuminating all the building interiors. It was finally decided, owing to the great cost and uncertainty of securing service at that time, and the chief hazard, to light up only one-fifth of the buildings and closing the rest at night, the large Machinery Hall or Main Building being the only one of the main buildings lighted. This was due largely to the electrical apparatus in operation in that building, and the local display of light. The ground lighting was principally done with gas, especially the decorative lighting. A few Jablochkoff candles were shown as exhibits. A few incandescent lights were placed outside on the grounds with very pleasing effect.

This brings us to the World's Columbian Exposition of 1893 at Chicago, which had over twice the area of any exposition so far held, and was the first to introduce decorative illumination on its main buildings in a comprehensive way by outlining and accentuating the cornices of the buildings and embankments of the "Court of Honor," there being some 8,200 incandescent lights of 10 candle-power placed for this purpose. The "Court of Honor," as well as most of the grounds, were lighted by arc lights; over 1,200 specially designed cast iron posts were used. These posts were hollow to admit of the concealment of the electric conductors. The cost of these posts with their setting was nearly $100,000. This was the first exposition to place the electrical conductors underground. This was required to prevent interfering with the view in the main vistas, and for that time was a great undertaking. The success of undergrounding at this exposition has enforced its adoption at all subsequent expositions in all important vistas. All the main buildings were lighted either for patrol, general illumination, for traffic or more brilliant illumination, such as the art gallery, where no less than 22,000 16 cp. lamps were used. Over one mile of picture light screens were in use. The total of the lighting at Chicago still maintains the record, there being in service on the grounds 5,687 arc lights. The larger contract for incandescent lighting was for 61,000 lamps, and with other contracts making over 100,000 sixteen candle-power incandescent lights, or a total of more than 1,600.000 cp. in incandescent light, and 11,374,000 (nominal) cp. arc; grand total, 12,974,000. Total inside area lighted by arcs, 4,877,965 square feet; area of buildings built by the exposition, 6,500,000 square feet; by States, 40,000; foreign, 30,000; concessionaires, 1,100,000. Total, 7,940,000—a little less than 200 acres.

As early as this exposition the incandescent lighting adopted at Omaha and the Pan-American was proposed for the "Court of Honor." Commercial rivalry and lack of support prevented. As the lighting had to be done by a number of contractors, it was feared that with the service that was available it would not be possible to obtain the desired results, and the original scheme was abandoned. However, the illumination that was finally accomplished, being new was accepted by the public with favor, and set the pace for subsequent expositions.

In 1894 at the Earl's Court, London, the embankments and decorative lighting of Chicago was repeated on a smaller scale.

The Mid-winter Fair held at San Francisco in 1894 had the buildings of the main court outlined principally on the cornices with 2,256 incandescent lights. The tower with flashing incandescent lamps, situated in the center of the main court as a spectacular feature, had 3,213 incandescent lamps mostly in color. The grounds of the main court were lighted by 96 arc lamps. There were altogether in the Mid-winter Fair 9,132 16 cp. incandescent, and 91 arc lamps.

The Cotton States and International Exposition, 1895, had some 5,000 incandescents placed on the exterior of the main buildings. The grounds were lighted with arc lights supported on hollow wooden posts. There were also a few trial lamp posts with incandescent lamp clusters. The grounds had 350 arcs.

The Nashville Exposition in 1897 had some 15,000 incandescent lights used in the illumination of the buildings. The central grounds were lighted by arc lights placed on hollow wooden posts bought from the Atlanta Exposition after its close.

At the Trans-Mississippi and International Exposition at Omaha in 1898 the first comprehensive and complete decorative and ground illumination by incandescent lamps was introduced. The Grand Court was entirely lighted by 8 and 16 cp. incandescent lamps. The buildings surrounding the court were of classic design, well adapted to outlining and decorative treatment. There were nearly 21,000 lights of 8 and 16 cp. used for this purpose. To light the grounds of the Grand Court 309 lamp posts with 12 to 20 incandescent lamps on each were arranged. They were the same hollow posts used at Nashville for arc lights, but cut down and covered with ornamental staff. This Grand Court lighting demonstrated beyond doubt the value of distributed lighting by small incandescent lights of 8 and 16 candle-power. In this, all concentrated or intense light was carefully avoided. The success attained in the Omaha lighting was due to the following:

First—The scheme and scope of the plans of the architects.

Second—To the distribution of the electric current to secure uniformity of illumination.

Third—To the economy or effectiveness secured through the arrangement of lighting.

Fourth—To the type of incandescent lamp.

Fifth—To the character of the apparatus

which was sufficiently flexible to secure constancy.

Sixth—To the care and vigilance used in maintaining proper candle-power in the lamps.

It may be appreciated that any indifference in the operating would have given a dimness or a brightness to the incandescent lamps, either of which would have been apparent as faulty.

Sometime after the closing of the Omaha Exposition, a writer commented on the illuminative effect as follows: "There was a time when Mr. Edison stood alone as to the decided merits of incandescent over arc lamps for lighting considerable areas, but happily the converts of diffused lighting, when properly executed by competent engineers, are rapidly increasing. Those who remember the old Louisville Exposition of 1883, and the wonders there accomplished by properly distributed incandescent lamps, remember it was predicted that twice the number could not produce the effect desired."

The Omaha illumination earned for the writer a gold medal and diploma, which was the highest award given by the exposition.

A commission was sent by the Paris Exposition of 1900 to investigate the illumination at Omaha in 1898. The Paris Exposition failed to profit by the experience of years as exemplified at Omaha, and was a distinct step backward as far as illumination was concerned. No uniform scheme of illumination was there adopted. The lighting was a mixture of large and small incandescents, searchlights, projectors, display lighting of the spectacular order, acetylene, Nernst lamps, Welsbach burners, gas and other illuminants—a conglomeration which was entitled to more credit as an exhibition of all known modern forms of lighting than as a comprehensive scheme of exposition illumination. Owing to the assumed available and liberal use of Niagara Falls power by the Pan-American Exposition, the electrical expectations were keyed to a phenomenal point. Electricity turned loose in fanciful display and effects, possible even if desirable only in imagination. To satisfy this impression and create a satisfactory showing a superior illumination was planned and installed. The exterior illumination at the Pan-American Exposition includes the largest vistas of any exposition yet attempted. The area looking north from the pylons to the Electric Tower is 1,400,000 square feet (that of the "Court of Honor," Chicago, being 650,000 square feet). To this 1,400,000 square feet might properly be added the area of the plaza back of the Electric Tower. The main areas are illuminated as far as is practically attainable without severe shadows, and the illumination borders on being brilliant in its effect. To secure the results which are apparent at the Pan-American, a scheme of general distribution of illumination by 8 candle-power incandescent lamps entirely is employed. All obtrusive or display lighting in the main vistas has been discouraged as detrimental to the general effect. For this reason no arc lamps are used, and for the same reason high candle powers are avoided.

It must not be inferred that a good illumination to selected conditions, can not be effected with gas in its various forms, or with arc lights. The advantages, however, in placement alone would recommend the incandescent light above all other sources of light in exposition illuminations.

There is a general increase in the number of lights as one approaches the Electric Tower, which is the climax of the lighting scheme. To secure the best results it is essential in all artificial illumination to get uniform diffusion of light. This cannot be reached by the arrangement of a few extremely brilliant centers about the space to be lighted, because we cannot rival the sun. In fact such an arrangement acts in itself to defeat the object to be attained. There will be a large portion of light immediately about the sources, while the remainder filters, as it were, through space growing weaker and weaker as it recedes from the sources in obedience to the unvarying law of inverse squares. Methods of artificial illumination necessarily have some objections, whatever their form. For example, it is often necessary to locate lights in the line of vision. This difficulty must be met by the simple expedient of a more minute subdivision and uniformity of distribution of lamps. As a practical standard 16 to 20 cp. lamps should be the largest used. From the structural and decorative standpoint to secure the best results we must have lamps so small as compared with those now in common use, that they give but little light individually, but capable of being so grouped, massed or distributed as to produce the desired effects and diffusion without raising any point of space to a brilliancy disagreeable to the eye to rest upon. Until the present time, large units of electric light have been depended upon to bring into greater prominence the beauties of surrounding effects. But in thus using the light we fail to avail ourselves of the beauty which is inherent in the light itself when the light is secured from myriads of small units.

(To be continued.)

DEVELOPMENT OF THE NERNST LAMP IN AMERICA.*

BY ALEXANDER JAY WURTS.

(*Continued from page 167.*)

Explanatory Notes.—The Hefner unit of candle power has been adopted in this paper so that ready comparisons may be made with results obtained on the Nernst lamp in European countries.

Names of Parts in the Nernst Lamp: The "glower" is the filament or light-giving body. The "ballast" is a steadying resistance connected in series with each glower. The "holder" is the removable piece containing glowers and heaters. The "heater-porcelain" is the porcelain disk in the holder immediately back of the heater. The "heater-case" is a small glass globe used in the six-glower and thirty-glower lamps.

CUT-OUTS.

An automatic lamp requires a cut-out to disconnect the heater from the circuit as soon as the glower shall have lighted. This is another one of those details that Dr. Nernst developed and exhibited in some of his early lamps, but which we have sought to still further perfect and to adapt to the special types of lamp which we have constructed. The cut-out involves a coil, a moving member and a contact, all of which must function at a temperature of about 110° C. without possibility of failure. The coil must therefore be heat proof, the contact must not weld, and the moving member should not hum on alternating current. These requirements are severe, but they have all been met in a most effective and satisfactory manner by embedding the coil in cement, by making the contact of silver, and by suspending the moving member from a single point of support.

The latter feature of the cut-out is illustrated in Fig. 6; 1 is the coil; 2 the core; 3 the armature or moving member, which is round in section; 4 is a silver band which makes contact by gravity with two silver wires not shown, forming a V; 5 is a strip of sheet steel .007 of an inch thick, which is inserted into the armature and securely held by a pin; 6 is a small steel rod or support for the armature, and 7 is a hole in the steel strip 5, somewhat larger in diameter than the pin 6, so that when the armature is attracted by the magnet, there is practically only a single point of contact between the strip 5 and the supporting pin 6. This construction has resulted in a cut-out which entirely avoids the humming sound so persistent in the ordinary types of alternating current apparatus.

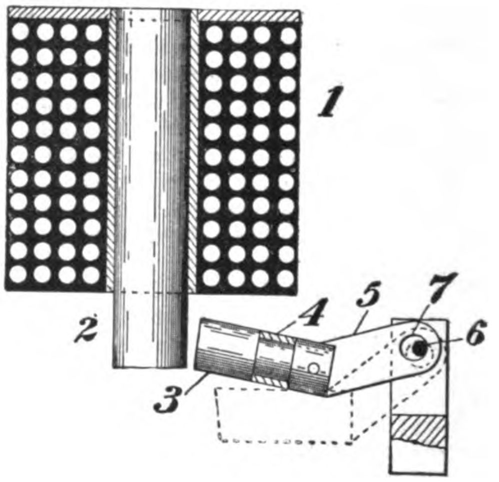

Fig. 6.

Lamps.

The lamps thus far developed are indicated in the following table:

Candle Power.	Voltage.	No. of Glowers.	Style.
50	110	1	Indoor
50	110	1	Outdoor
50	220	1	Indoor
50	220	1	Outdoor
100	220	2	Indoor
170	220	3	Indoor
400	220	6	Indoor
400	220	6	Outdoor
2000	220	30	Indoor

The main features are the same in all. The indoor lamps are provided with ornamental spun brass housings; the outdoor lamps with neat japanned cast-iron housings. Single glower lamps have single pole cut-outs, whereas all the multiple glower lamps are provided with double pole cut-outs, the reason for this difference being that the extremely high temperature in the immediate neighborhood of a number of glowers tends to establish leakage currents between the glowers and heaters, unless the latter be entirely disconnected from the circuit.

We will examine in detail the six-glower lamp as typical of all the others. This lamp is suspended from an eye-bolt which, being removed, allows of immediate access to the inner parts. On removing the housing, we find that the ballasts are placed in a semi-circle around the cut-out, the arrangements of the parts being such as to make all easy of access. The connections are made with small aluminum plugs on the ends of the interconnecting wires which avoid the many familiar inconveniences associated with set screws. All the parts are mounted on porcelain; in fact, there is no combustible material whatever in the lamp. The heaters and glowers are attached to a removable piece or "holder," the design being such that the heaters backed by a porcelain disk are immediately above the glowers, resulting in the following advantages: Stagnation of heat from the heater, thereby lighting the glowers in minimum time; no shadows, nearly all the light being thrown downward where it is ordinarily most desired; stagnation of heat from the glowers whereby the latter are run in their own heat and therefore at a higher efficiency than they would otherwise. The glowers and heaters are attached to the binding posts of the holder by means of small aluminum plugs, so that the perishable members are always easily and conveniently interchangeable. The holder is provided with nine contact prongs, which, when the holder is pushed up into the lamp, automatically make the desired connections. These are shown in Fig. 7; 1 and 2 represent the line terminals; 3 the actuating coil; 4 and 4 the double pole cut-out; 5 the heater; 6 the glowers, and 7 the ballasts, there being, of course, one ballast for each glower. A small glass globe, called the "heater-case," is held by spring clamps around the glowers, the function of which is to retain the heat and thereby decrease the time of lighting as well as increase the efficiency of the glowers. In service, the "heater porcelain," which is the porcelain disk immediately above the heater, becomes coated with a thin layer of platinum black, unless measures are taken to prevent it, and this not only decreases the illuminating power of the lamp, but if not removed, will in course of time become conducting and cause leakage of current. No simple means have been discovered for removing the platinum black from the porcelain surface. This difficulty, nevertheless, has been avoided by coating the surface of the porcelain with a thin layer of white paste, which may be easily removed with a stiff brush or scraper. The platinum black now deposits on this coating, both of which may be removed together, leaving the fresh, white surface of the original porcelain to be recoated for further service; but even should the platinum black be allowed to accumulate, all danger of leakage currents is avoided by surrounding the holes through which the lead wires pass, by small annular rings or grooves, it having been discovered that the platinum black will not deposit in these small spaces; the continuity of the platinum black surface between the lead wires is thereby interrupted. For higher candle powers the six glower holder is used as a unit and this may be multiplied to any desired limit.

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*Paper read at the 18th Annual Convention of the American Institute of Electrical Engineers, Buffalo, N. Y., August 23, 1901.

The quality of the light is remarkable for its beauty and close approximation to daylight. All colors are seen in their proper shade, making the light especially desirable in stores, art galleries, drawing-rooms and the like. The absence of shadow, the steadiness of the light, the simplicity and low cost of maintenance, the high efficiency of the lamp, and the fact that it is operative on 3,000 alternations, are features that will commend themselves strongly to the lighting world.

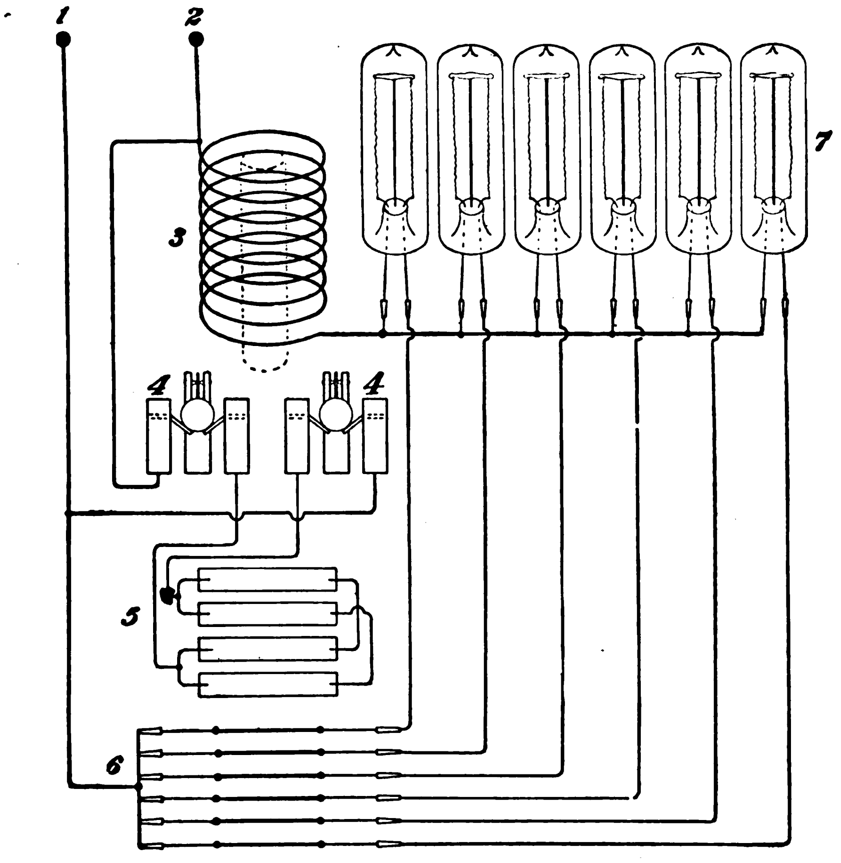

Fig. 7.

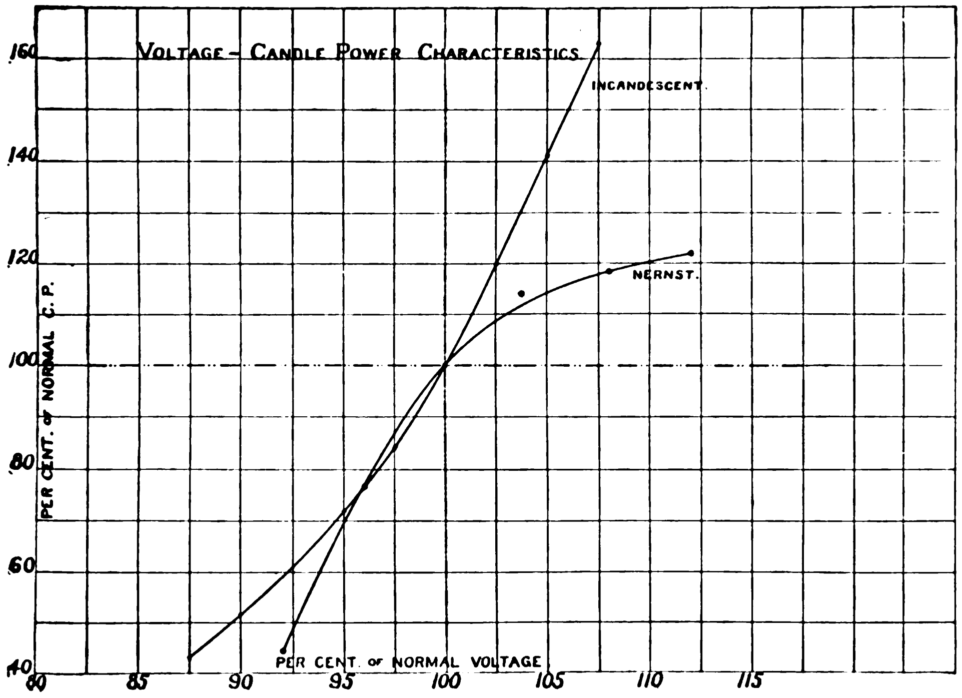

Fig. 8.

Efficiency.

It is not an easy matter to state the efficiency of a light, and the difficulties are especially pronounced in the case of the Nernst lamp It would seem desirable, therefore, to give the results of various methods of measurement and comparison rather than to make any definite statement based on any particular method or set of readings. Referring, therefore, to the six-glower, 220-volt, alternating-current lamp, from which most of the data has been obtained, we may note the following:

A 220-volt glower operating at its normal current of .4 of an ampere, requires 20 volts more in the open air than when burning with five other glowers in a three inch globe. The lower voltage and consequent better efficiency. when using multiple glowers in a globe, is due to the fact that the glowers are operating in a highly heated atmosphere. The efficiency of the six glower lamp with clear heater case, but without the dome shade, is 1.2 watts measured in the direction of greatest intensity.

A more satisfactory statement will be found in the accompanying table [table will be found on the next page] giving the spherical and lower hemispherical efficiencies of the six-glower Nernst lamp, together with the corresponding figures of alternating current and direct current inclosed arc lamps:

The arc lamp figures were taken from the Report of the Committee for Investigating the Photometric Values of Arc Lamps, read before the National Electric Light Association in May, 1900. Examining this table, it will be noticed that the spherical efficiency of both arc lamps is better than that of the Nernst. In the lower hemisphere, the Nernst is somewhat better than the alternating current arc and not as efficient as the direct current arc. When reflecting shades are used, the alternating current arc again has a slight advantage for the whole of the lower hemisphere; but if we disregard the mean of the lower hemisphere and consider the floor or desk illuminating power of the lamp, we find that the Nernst lamp has a very decided advantage over the inclosed alternating current arc; for example, if we consider the mean of the lowest 30 per cent. zone, the efficiency of the inclosed alternating current arc is 1.56 watts against one watt for the Nernst and the mean of the lowest 60 per cent. zone is for the inclosed alternating current arc, 1.45 watts against 1.23 watts for the Nernst.

					Mean Intensity in H. U.						Watts per Mean H. U.					
					Spherical.			Lower Hemisphere.			Spherical.			Lower Hemisphere.		
	Voltage.	Current.	Watts.	Power Factor.	Opal Outer.	Clear Outer.	Shade.	Opal Outer.	Clear Outer.	Shade.	Opal Outer.	Clear Outer.	Shade.	Opal Outer.	Clear Outer.	Shade.
6-Glower	220	2.35	517	1.0	149*	..	147	246*	..	279	3.47*	..	3.5	2.15*	..	1.85
A. C. Arc......	110	6.29	417	·6	130	159	152	..	190	254	3.21	2.62	2.49	..	2.23	1.48
D. C. Arc......	110	4.9	539	1.0	177	207	..	..	272	..	3.03	2.60	..	..	1.98	..

An opal inner globe or heater-case was used in all cases except the four readings marked *.

*A clear heater case and sandblasted spherical globe were used.

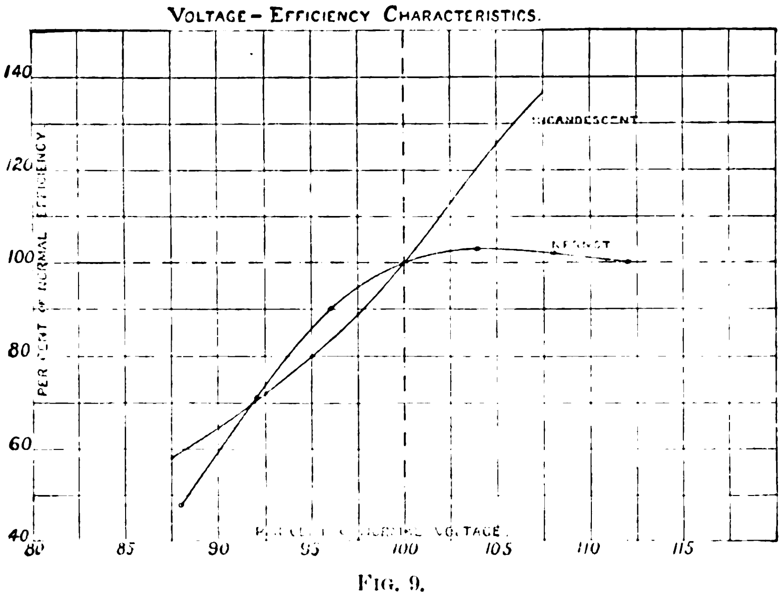

FIG. 9.

Comparisons between the illuminating powers of the Nernst and incandescent lamps indicate a watt consumption in the Nernst lamp a little less than half of that in the incandescent for equal illumination. The superior quality of the Nernst lamp is also very marked both for reading purposes and for the correct determination of color.

A similar comparison between the illuminating power of the Nernst and inclosed alternating current arc lamps shows for an equal consumption of watts in the two lamps, a much superior floor illumination for the Nernst lamp, slightly better general illumination for the arc lamp; but the quality and steadiness of the Nernst light, together with the entire absence of shadow, give an impression of decided superiority in favor of the Nernst.

The two sets of curves, Figs. 8 and 9, show interesting comparisons between the Nernst and incandescent lamps under conditions of varying voltage. Fig. 8 shows the relative change in candle power and Fig. 9 the relative change in efficiency, all the variations in each case being given in per cent. of normal conditions. These curves are self-explanatory except as to the remarkable steadiness of candle power in the Nernst lamp when forced above normal voltage. The feature is due to the great corrective power of the iron ballast.

At present our data regarding the effect of running Nernst lamps at different efficiencies is rather limited. Figures of this character require many readings under all kinds of conditions and it may be some time before these can be satisfactorily and definitely recorded, but roughly, it may be stated that the efficiency of the glowers falls but slightly during their natural life, provided the lamps are kept properly cleaned.

(To be continued).

The Dark Continent Railway.

The progress of the railway which will one day stretch from end to end of the Dark Continent is unresting, if unhasting. It is learned from Rhodesia that in the course of an interview at Bulawayo, Mr. Townsend, the railway engineer recently returned from the Zambesi, is reported to have stated that the railway to the north will not stop at Victoria Falls, but will go straight on to the rich copper mines, 300 miles beyond that point. He estimates that the coal traffic will amount to from 200,000 to 300,000 tons per annum, which will make the railway pay. The falls could be reached in eleven months if material were obtainable, but he expects construction will take two years. Mr. Townsend further stated that there is an enormous source of power in the falls, sufficient to run trains for hundreds of miles by electricity and to supply power for coal mines and other works.

OUR FRIENDS, THE ENEMY.*

BY GEORGE P. HAYWOOD.

I have heard it said by those acquainted with the great American game that the man who is caught bluffing loses. There have been frequent illustrations of the truth of the above proposition within the last five years in the contest which has been going on between the Bell and the Independent people.

When the Independent movement in telephony started a few years ago the Bell Telephone Company, with its different branches, had become a giant monopoly, proud, arrogant, dictatorial. In its clutches grasping the entire country, it felt its fortifications were impregnable. It was in fact a giant of wonderful proportions and it believed its strength sufficient to cope with all opposition. It not only by its patents controlled telephony throughout the country, but it so connected its personnel and its financial interests with other great corporations and monied concerns until there was between them such a mutuality of interest that you no sooner touched the interest of the Bell people than you were confronted by an unsuspected adversary who heretofore perhaps had been your friend. No sooner did you attempt to start the movement of an Independent telephone exchange than you were surprisingly confronted by the opposition of your neighbor who happened to be an employe of the Western Union Telegraph Company, or of some railroad company, or a small stockholder of some branch of the parent company, or perhaps a retained lawyer of some railroad or other corporation. He would not only refuse to permit you to enlist him as a subscriber, but he at once began his neighborly and friendly functions of advising you that you must not proceed further, at the risk of losing your money and your reputation for common sense as well, for you were going up against the real thing, and your little company in the way of the Bell would be only as a fly speck on the map of the country. If that was not sufficient to scare you into submission your other neighbors and friends and the merchants and people of the city were seen, out of commiseration for you and in your behalf, and advised to have nothing to do with you, first, out of friendship for you; second, out of friendship for themselves, for the reason that you could not accomplish anything in the telephone business, because your apparatus was crude and worthless; thirdly, you could not procure competent help to even build, much less operate, an exchange, for all such competent help was controlled by the Bell people; and, lastly, should you attempt to use proper telephones and switchboards, you would be infringing the patents of the Bell, and not only you, but every subscriber, would be proceeded against for damages in the United States Courts. Yes, think of it, not in your own court at home, but carried away from home and into the Courts of the United States.

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*Paper read at the Sixth Annual Session of the Indiana Mutual Telephone Association, held at Laffayette, July 29-30.

If all this did not deter you and prevent you from building an exchange, you were sneered at during its construction. You were smiled upon with derision. Your friends were told that you would not be able to move a peg when your exchange would be completed, as you would be enjoined from proceeding to operate your exchange.

If you had the courage and manhood, pluck and energy, and built your exchange and began its operation you were not enjoined. You were not interfered with by any honorable means. You did not have an honorable competitor in the field against you, but had a competitor supposedly strong in financial resources, with nearly a quarter of a century's business built up to sustain it, with capable men, and men of large financial influences behind to push it; yet this giant concern was not courageous enough, was not fair enough, was not honorable enough to meet you in open field and let merit win. Instead, the Bell people and their influences attacked you by a method which has been properly termed "guerilla warfare." They sought to crush you and drive you out of business by reducing the price, which if you met you could not succeed. They even went further and gave telephone service for nothing. This of course, had you followed them, would have been ruinous to you. You could not afford to do it, and if you have succeeded in the Independent telephone business you have succeeded because you have stood by your rates as first established, continued with courage, energy and judgment the even tenor of your way, and you have succeeded far beyond your fondest expectations.

Such is a brief outline of the opposition which every Independent exchange has met during the last six years. It is said that competition is the life of trade. No man ought to object to honorable competition; no man or set of men is justified in resorting to dishonorable methods to compete with a rival. It seems strange indeed that a corporation so long established, with the ramifications of its business extending throughout the United States, with financial resources behind it, with the strong business connections that the Bell Telephone Company has, could not honorably compete with the newly born, unorganized and financially weak Independent Telephone movement that commenced some six or seven years ago. It seems strange that the Bell people would stand by and simply bluff and threaten and by such intimidation . seek to drive from the field the Independent people. Many have marveled at this seeming stupidity on the part of the Bell people. A study of the history of the telephone litigation that has been going on for the last six or eight years, however, will reveal the reason for the course pursued by our adversaries. They expected by fraud and chicanery to continue their monopoly for many years to come, by procuring patents upon so-called new inventions, which were necessary to the use of the telephone business. They expected to succeed in this by their powerful influence and financial strength, and because of the weakness and unorganized condition of the Independent people. In this they were defeated. They were met in their attempt to carry out this scheme by men worthy of their steel. The Government of the United States, through its Attorney General, came to the assistance of the Independent people, that is, the Government, to the extent just mentioned, took a hand in the litigation in order that no fraud should be perpetrated and that justice to all should be done.

While the Independent people were busy building exchanges and toll lines throughout the country, and especially in the middle West, and while the Bell people throughout these different localities were threatening and bluffing, the leaders of both parties were engaged in a great legal battle in the courts of our Government. Had the Bell people succeeded in establishing its patents, and thus continuing its monopoly, financial ruin, quick and sure, would have been the only result to all Independent people so far as the telephone business was concerned. There would have been foisted upon the people a continuation of the high prices and poor service that had prevailed with the Bell people before the Independent movement began. Too much praise cannot be given those who came to the front and fought the battles for the people against this giant monopoly, and won.

When we look back through the last six years and reflect upon the many means used in opposition to the Independent movement, and consider our weakness and unorganized condition, we can but wonder at the success we have attained. We owe much of this success to the loyalty of the people whose patronage we sought and obtained. They had not forgotten, and they will not soon forget, the extortions they had been subjected to for so many years by the Bell people and the very poor service rendered them.

We also owe much of our success to the Bell people themselves, and in this respect the saying "our friends the enemy" was never more aptly applied than to the Bell people. In every instance, so far as I have been able to ascertain, the old company, when threatened at any place with a new independent exchange, not only continued its high prices, but continued its poor service, and neglected to put its exchange in proper condition whereby good service could be rendered. While the new exchange was being built it so continued, then as soon as the new exchange was in operation it cut its prices and frequently gave free telephone service. This to every thinking man was an acknowledgment of the weakness of its position and the motive for doing so was so illy concealed that every reasonable man knew that if they should succeed in driving out of business the new exchange the old conditions of the Bell monoply would be resumed. In a very few instances they have succeeded by purchasing or in some other manner getting rid of the new company, and in every such instance they have gone back to their old methods and high prices. These facts have made sufficient warnings to the people and they have loyally stood by the Independent movement.

- The success of the Independent people has been almost marvelous; especially is this true in our own State. For a quarter of a century the Bell people, through their franchises, have been doing business in this State. They now have in operation, as claimed by them, about twenty-two thousand telephones. The Independent movement is but six or seven years old; there are to-day in operation in the State of Indiana over fifty thousand telephones.

Speaking of local conditions: On the first of January, 1895, the La Fayette Telephone Company, then known as the La Fayette Harrison Telephone Company, commenced operations with three hundred telephones. It has run the gauntlet of obstructions and questionable tactics of the Central Union people, such as have been mentioned heretofore, even to having to compete with free Central Union Telephone service. To-day there are about fifteen hundred telephones in operation by the La Fayette Telephone Company's exchange. It is not known definitely how many telephones are in use in the Bell exchange, but the number is small compared with that of the La Fayette Telephone Company. The best test of the usefulness and the strength of the two exchanges is found in the number of messages transmitted in a given time by each. It has been stated by persons using both the Bell and La Fayette telephones in their places of business that at least ten messages come over the La Fayette lines where one comes over the Bell lines. This is the result of the Bell methods and the methods used by the La Fayette Telephone people. While it is true that a few people will forsake the Independent exchange and their own best interest because of cheaper rates or no rates at all with the Bell, the large majority of people know the danger to themselves if there should be no Independent exchange in existence in their city.

There are some few people who always expect others to bear their burdens; they are very willing that their burdens should be borne by others. Those few people will take advantage of the "guerilla" methods used by the Bell people and use their telephones because they can get them for less, or for nothing. Others, and the very large majority, with better judgment, are willing to pay a reasonable price for telephone service, and, at the same time, protect themselves from the future oppression of the Bell people. It is the duty of the managers of every Independent exchange, as well as all toll lines, to supply the people with the very best service. We owe this to the people who have so loyally stood by us. It is to our interest to give such service because we thereby succeed. We owe it to ourselves and to the people who stand by us to thoroughly organize and stand together, to be faithful and true to each other and to the Independent movement. So long as we do this we need have no fear, but can rest assured that further and greater success will reward our efforts.

An Overlooked Point in Power Transmission.

I stumbled across a point in electric transmission of power the other day that I had not thought of before, but since I have been awakened to the point I think it is worth considerable attention. The discovery was not from an experiment in electric transmission, either, but the electric thought came to my mind from seeing a band saw that had vibration. It had it bad, too, so bad in fact, that the purchaser of the machine and the builder had been having quite a tilt about it. The machine had been taken all to pieces, every part that moved or revolved had been tested and balanced separately, and the whole collectively, and still that vibration of the top wheel remained.

Now, do you know where my thinking cap got in its work? I got an idea in my head that possibly the belt that drove this machine might have a little jerk to it that caused the vibration, and though the owner of the machine assured me that there was nothing of the kind, I could not help but think of how positively this point would be settled if the machine were driven by an electric motor. There would be no chance then to go behind the returns, so to speak, for there could not possibly be anything further back along the line than the motor to look to in removing a trouble of this kind—and this would narrow down the territory in which we would have to search for the trouble considerably. In fact, we would know that the trouble could all be found right in the machine, and when we were positive of that point we would soon find it by a careful hunt. Can we do that with belt-driven machinery? Wait till I tell you some things that have come under my personal observation, and then think some before you decide on this point.

I was one time connected with a plant using about 90 hp. from one engine. Everything was belt driven, and by the time the whole plant was belted up there was quite a lot of belting, and incidently several strings of shafting. Way down at the outer end of the main line of shafting was a drag saw. This was not such an immense machine in itself, but was just an ordinary drag saw for cutting logs in two, and was driven with a six-inch belt—but what that thing did to the balance of the place is what I want to tell you about. When that saw would get down to work earnestly in a good sized log its belt would begin to jerk and jump, and then other belts about the place would get their sympathetic nerves aroused and begin to sway in unison with this drag belt till you could notice the jerk clear back in the engine room.

To give you some idea of how acute the trouble would grow at times from this one little thing, I will say that not only could it be noticed in the movements of the slowest machines about the place, but there was a little pony saw mill at one point on the line, driven from a counter which was belted overhead from the main line, and the belt across there would get to jerking so at times that the operator would throw his clutches out and stop the mill at times for fear of jerking the counter shaft down. More, too, this same counter shaft which was of goodly dimensions for the work it had to do, broke twice in one season, and I am ready to wager that much of the cause for this could be justly laid to the jerk from that drag saw on the line.

Do you begin to see the point I am driving at in electric transmission, and don't you think it is worth more than passing attention? Take any high speed machine and think of the trouble it is at times to prevent vibration, and in many of them it is positively essential that all vibration be eliminated. . Then even let us suppose that there is no drag saw or other particularly jerky machine on the line to cause trouble, any little wobble in a line or counter shaft, an unbalanced belt and many little things foreign to the machine itself might cause all our troubles, while if we had electric transmission all chance of this would be done away with, for there would be no cause to go behind the immediate motor driving the machine—no going behind the returns. We are coming over to electric transmission rapidly, too much so maybe in some cases, and I think we should weigh matters carefully in figuring on the problem. I think we should carefully look up all the flaws that can be found in the system, weigh them carefully and not be carried away with the mere name because it is surrounded with greatness and mystery, but I do think that we should also give to this system all the good points due it, and one of these which I think should not be forgotten is the one I have been talking about here.—"Zeke" in the "Age of Steel."

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended September 18:

Amsterdam, 1 package, $10; Antwerp, 42 packages, $2,864; Argentine Republic, 69 packages, $20,988; Australia, 11 packages, $587; Barcelona, 47 cases, $2,500; Belfast, 3 packages, $418; Brazil, 9 cases, $646; 15 packages, $328; Bremen, 1 case, $81; British East Indies, 997 packages, $112,808; British Possessions in Africa, 2 cases, $145; British West Indies, 24 packages, $131; Cadiz, 5 cases, $290; Central America, 23 packages, $844; Cuba, 370 cases, $4,547; Ecuador, 45 packages, $3,375; Genoa, 3 cases, $11; Glasgow, 10 cases, $918; Hamburg, 1 package, $45; 44 cases, $1,690; Havre, 3 packages, $85; 2 cases, $40; Hayti, 31 cases, $49; Helsingfors, 1 case, $75; Liverpool, 72 cases, $4,126; London, 170 cases, $7,802; Madrid, 12 cases, $650; Mexico, 33 cases, $934; Newcastle, 7 cases, $250; Nice, 7 cases, $300; Nova Scotia, 12 cases, $720; Peru, 43 cases, $2,547; Portsmouth, 1 case, $12; Preston 2 cases, $415; Rotterdam, 1 package, $45; 2 cases, $15; Santo Domingo, 44 cases, $723; Sheffield, 13 cases, $1,100; Southampton, 3 packages, $195; 12 cases, $1,700; Trieste, 2 cases, $45; U. S. Colombia, 1 case, $10; Venezuela, 180 packages, $1,342; Vienna, 4 packages, $125.

PERSONAL MENTION.

Mr. Chauncey A. Cornell has accepted a position at the works of the Stanley Electric Company at Morningside, Pittsfield, Mass.

Mr. F. O. Bloodgood, superintendent of the electric light plant at Geneva, N. Y., has been appointed superintendent of the plants at Waterloo and Seneca Falls, N. Y., to succeed Elbert A. Bradley.

Mr Elmer P. Morris, of the Morris Electric Company of New York, recently returned from a business trip to Cuba.

INCORPORATIONS.

The Phoenix Gas & Electric Company, Trenton, N. J. Capital stock, $1,000,000. Incorporators: William D. Lippincott, Walsh Banyard and David Rambold.

The Tunica Electric Light & Power Company, Jackson, Miss. Capital stock, $2,500. Incorporators: Leo Lesse, J. T. Watson and A. J. Dorsey.

The Oak Grove Electric Company, Oak Grove, Pa. Capital stock, $1,000.

The Texas Telegraph Company, El Paso, Tex. Capital stock, $3,000. Incorporators: William H. Baker, Edward C. Platt and Charles P. Bruch.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED SEPT. 17, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

682,608. Trolley. Francis A. Crans, Waverly, N. Y. Filed June 18, 1901.

682,625. Car-Fender. Solomon Leivy, East St. Louis, Ill. Filed April 12 1901.

682,639. Trolley. David J. Rosen, Brooklyn, N. Y. Filed June 13, 1901.

682,643. Car-Fender. Rocco Salomone, Paterson, N. J., assignor of one-half to Thomas F. O'Grady, same place. Filed May 2, 1901.

682,705-682,707. Contact Device for Conduit Electric Railways. Wilton F. Jenkins, Richmond, Va. Filed Feb. 7, 1901.

682,708. Suspensory Device for Trailing Contacts for Conduit Electric Railways. Wilton F. Jenkins, Richmond, Va. Filed Feb. 7, 1901.

682,710. Bond for Electric-Railway Conductors. Wilton F. Jenkins, Richmond, Va. Filed Feb. 7, 1901.

682,711. Conduit for Electric Railways. Wilton F. Jenkins, Richmond, Va. Filed Feb. 7, 1901.

682,801. Controlling Device for Motor Vehicle Driving-Trains. Thomas B Jeffery, Chicago, Ill. Filed Oct. 27, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

682,690. Electric Lamp. Peter C. Hewitt, New York City, assignor to Peter Cooper Hewitt, trustee, same place. Filed April 5, 1900.

682,691. Method of Operating Electric Lamps. Peter C. Hewitt, New York City, assignor to Peter Cooper Hewitt, trustee, same place. Filed April 5, 1900.

682,692. Method of Manufacturing Electric Lamps Peter C. Hewitt, New York City, assignor to Peter Cooper Hewitt, trustee, same place. Filed April 5, 1900.

682,693. Starting Apparatus and Circuit for Electric Lamps. Peter C. Hewitt, New York City, assignor to Peter Hewitt Cooper, trustee, same place. Filed April 5, 1900.

682,694. Electric Gas or Vapor Lamp and Electrode Therefor. Peter C. Hewitt, New York City, assignor to Peter Cooper Hewitt, trustee, same place. Filed April 5, 1900.

682,695. Method of Controlling Gas or Vapor Electric Lamps. Peter C. Hewitt, New York City, assignor to Peter Cooper Hewitt, trustee, same place. Filed Jan. 25, 1901.

682,696. Method of Producing Light by Electricity. Peter C. Hewitt, New York City, assignor to Peter Cooper Hewitt, trustee, same place. Filed Jan. 25, 1901.

682,697. Apparatus for Producing Electric Light. Peter C. Hewitt, New York City, assignor to Peter Cooper Hewitt, trustee, same place. Filed Jan. 25, 1901.

682,698. Inclosing Case for Electric Lamps. Peter C. Hewitt, New York City, assignor to Peter Cooper Hewitt, trustee, same place. Filed April 5, 1900. Renewed April 30, 1901.

682,735. Packing-Case for Incandescent Mantles. Mortimer McRoberts, San Francisco, Cal. Filed Aug. 15, 1900.

682 742 Portable Electric Lamp. Herbert E. Plass, New York City. Filed April 20, 1901.

682,978. System of Electrically Lighting Railway-Carriages. Emil Dick, Baden, Austria Hungary. Filed Feb. 25, 1899.

ELECTRICAL MACHINERY AND APPARATUS.

682,618. Electrical Starting and Regulating Switch. Arthur H. Hickley, Rock Ferry, Eng. Filed May 6, 1901.

682,634. Cooling-Coil. Ferdinand Messmer, St. Louis, Mo. Filed May 15, 1901.

682,729. Electric Switch. Herman A. Metz, Brooklyn, N. Y. Filed July 5, 1899.

682,898. Dynamo-Electric Machine. Charles De Witt Anderson, Chicago, Ill. Filed Oct. 22, 1900.

TELEPHONES AND TELEPHONE APPARATUS.

682,732. Supervisory Signal for Telephone Systems. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric Company, Chicago, Ill. Filed Nov. 18, 1897.

682,983. Telephone Toll Apparatus. William Gray, Hartford, Conn., assignor to the Gray Telephone Pay Station Company, same place. Filed Jan. 5, 1901.

MISCELLANEOUS.

682,642. Means for Controlling Electric-Motor Vehicles. Joseph Sachs, Hartford, Conn. Filed July 26, 1900.

682,648. Dry Battery. Henry Splitdorf, New York City. Filed May 27, 1901.

682,661. Electrical Thermostat. Theodore J. Zoeller, Nashville, Tenn., assignor to the Standard Automatic Fire Alarm Company, Huntsville, Ala. Filed Dec. 14, 1900.

682,678. Electric Clock. Robert J. Flint, Decatur, Ill., assignor of one-half to Frank Curtis Company, same place. Filed May 21, 1901.

682,709. Insulator. Wilton F. Jenkins, Richmond, Va. Filed Feb. 7, 1901.

682,714. Means for Protecting Circuits. John F. Kelly, Pittsfield, Mass. Filed June 5, 1901.

682,796. Electromagnetically-Operated Door-Opener. John M. G. Gould, Boston, Mass. Filed Nov. 26, 1900.

682,828, Electropneumatic Controlling System. Ernest R. Hill, Wilkinsburg, Pa. Filed Jan. 13, 1900.

682,831. Adjustable Insulator. Henry D. Murdock, Pittsburg, Pa. Filed April 18, 1901.

682,919. Electric Fuse. Louis W. Downes, Providence, R. I. Filed June 11, 1901.

682,943. Method of Changing Frequency of Alternating Currents. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed July 24, 1897.

682,949. Electric Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car-Heating Company, same place. Filed Nov. 28, 1898.

682,971. Electrostatic Measuring Instrument. James H. Bryson, St. Louis, Mo., assignor to the Wagner Electric Manufacturing Company, same place, Filed March 18, 1901.

682,973. System and Apparatus for Loading and Unloading Storage Batteries from Motor-Vehicles. George H. Condict, New York City, assignor to the Electric Vehicle Company, same place. Filed October 19, 1898. Renewed July 29, 1901.

THE TELEPHONE WORLD.

London to Have New Telephones.

Post Office telephones will be open to the public in London early in October. This innovation has come about partly through the growth of sentiment favoring public ownership of all quasi-public utilities, but more from the inefficient service rendered by the National Telephone Company, which controls telephone patronage throughout the United Kingdom.

In the telephone system which the Post Office authorities are now establishing in London the greatest effort is being made to have everything up-to-date. Previous to the work of construction competent electrical engineers were sent on special missions to the principal cities of the Continent, where both private and public control obtains and to the United States, for the purpose of getting all the new ideas, and incorporating the best in the new system for London. All batteries will be at the central station, and the lifting of the receiver will connect the subscriber with "central," while the replacing of the receiver will "ring off." The wires will be so arranged that there can be no overhearing and they will be no longer overhead, but will be laid in underground conduits, as in many American cities.

The claim is made that the new system will not only be the biggest but the best in the world. As to price, it will be the cheapest that can be found in any large city in the world. For a full service, allowing an unlimited number of calls, with extra charges only in a few special cases, the charge will be only $20 a year for business houses and $14 a year for residences. By an arrangement with the National Company it will be possible to connect with any of its subscribers throughout the United Kingdom without extra charge.

A change is to be made in the telephone system in New Britain, Conn., commencing October 1. The 'phones with the slot for the insertion of the nickel are to be abolished and in their places will be substituted, if the store owner wishes, a higher-priced instrument. There are a good many of these accommodation instruments in use in New Britain, and the change will not be pleasantly received by many of them. The price of these instruments is $10 per year, in addition to the nickel which is paid for each call. As a substitute for this arrangement, the company will offer a telephone costing $25 yearly, and allowing for 380 local calls. All calls in excess of this number will be charged for at the rate of four cents each. The slot system has been gradually done away with in every city of the State until New Britain alone remained with it. Its abolishment has been under consideration there,

Indications are that Montgomery, Ala., will soon have a new telephone company. It is understood from authentic information received that the Home Telephone Company will have its service inaugurated between the middle and latter part of October. S. T. Scott, of that city, will be manager of the Montgomery office. A list has been in circulation, and it is understood that 700 subscribers have been secured for the new company. The Home people are established in Birmingham, Knoxville, Mobile and several other Southern cities, and are considered to be in a prosperous condition. A switchboard costing nearly $60,000 has been ordered. The telephones to be installed will be of the most improved pattern. Instead of ringing the bell, you will only have to raise the receiver, and central will respond.

The Montreal "Herald" says: "The telephone line which has been completed by the Canadian Pacific Railway Company for the benefit of the royal party on its overland trip to the coast is quite a novelty in train equipment. It consists of an interconnecting system of telephones through the train of eight cars so that communication from any part of the train may easily be obtained. Each car has its own instrument, and considerable ingenuity has been displayed to overcome the vibration of cars in motion."

Mt. Olivet, Ky., is soon is have telephone connection with Carlisle. A company has been organized in Mt. Olivet for the purpose of erecting a line to Plummer's Landing, Licking River, and the line is now being built by way of Piqua. A Nicholas County company will build from Plummer's Landing to Carlisle. It is expected that the line will be completed soon.

The Home Telephone Company, which was recently granted a franchise to operate a telephone system in Springfield, O., will shortly begin the work of construction. The engineering force has completed its survey and the same has been accepted by the officials. The company expects to have the system in operation within six months.

The Northville, Mich., Telephone Company will increase its rentals to $12 per year for residences and $15 for business houses.

Telephones to Aid in the Mail Delivery.

A feature of the postal service not enjoyed by any other city in Michigan has been inaugurated in the Saginaw post-office. . It consists simply of a system of collecting and delivering mail in response to telephone calls for such service.

Its principal value will be in the delivery of letters in the same city. Mail intended for local delivery may be called for by the messenger and accepted for delivery, provided the postage is prepaid and a special delivery stamp is affixed. Upon receipt of the matter by the messenger he will at once take it to the post office, that it may be properly recorded. postmarked and the stamps thereon cancelled, as if mailed at that station, when it will be immediately taken out for delivery to the addressee in the usual manner.

Mail intended for dispatch to other cities may be called for in similar fashion, but two special delivery stamps are needed, one on an outer envelope addressed to the special delivery clerk of the post office, and another on the inner envelope bearing the proper address of the person to whom the letter is to be delivered. Mail matter intended for dispatch, but not for special delivery at the office of address, may be similarly collected by the special delivery messenger when the letter is inclosed in another to the delivery clerk and a stamp properly affixed. In this case only one special delivery stamp is necessary, but in all cases the payment of the usual two cents postage is necessary in addition to the other stamps.

The experiment is being watched with considerable interest by post office officials. It is said that if the department proves successful in the cities in which it is being tried it may be adopted in the smaller cities of the country where there is not too much ground to be covered.

Articles of incorporation of the Southern Iowa Telephone Company were recently filed with the county recorder in Des Moines. The paid-in capital stock is $60,000. The incorporators are R. T. Wellslager, L. M. Grimes, J. D. Whisenand and D. N. Smith. The company will take over and operate a system of toll lines extending south from Des Moines through Indianola, Winterset and Osceola to Mount Ayr and other points in Southwest Iowa and Northern Missouri. These lines have a Des Moines connection and have been successfully operated for several years. The intention is to improve the lines and extend them as occasion may demand and possibly to put in and operate exchanges in some of the smaller towns in the south part of the State to which the company has lines in operation.

At the third annual meeting of the Kentucky Telephone Association to be held at Owensboro, October 1 and 2, the address of welcome will be delivered by Mr. John D. Powers of Owensboro, and the following speakers have been selected: John R. Allen, of Lexington; D. L. Pendleton, of Winchester; W. C. Polk, of Louisville; J. W. Walker, of Henderson; Desha Breckinridge, of Lexington; James S. Bradley, of Louisville; H. K. Cole, of Owensboro; J. E. Zeluff, of Louisville; Richard Godson, of Midway, and C. A. Kienle, president of the Southern Indiana Telephone Association.

It is now possible to telephone through the Saint Gothard Tunnel in Switzerland, a cable having been laid. The entire length of this cable is 16,550 meters, of which 14,998 meters are laid in the tunnel. On the northern and also on the southern side of the pass the cable is taken through special iron piping from the mouth of the tunnel, and through the stations of Goschenen and Airolo, for a distance of about 775 meters, and the connection with the air lines is formed in a hut.

The activity of the independent telephone companies in the State of Kentucky is shown by the following figures: There are to-day over 20,000 telephones in use; five years ago there were 500. The capital invested is $3,000,000. There are 83 independent telephone exchanges in the State, and eight are in course of construction.

In Cincinnati, O., the county commissioners have decided to equip the courthouse with a private branch telephone exchange, and work on the new system will begin as soon as possible. The cost of the new system will be the same as the old system, and for the same money much better service will be obtained.

The Hudson River Telephone Company has men at work stringing additional wires for its long-distance service in New York State. Four more will be strung between Ballston and Saratoga, two to Schenectady and two to Troy.

Work has been resumed on the new building to be erected by the People's Telephone Company of Detroit, Mich. The structure, when completed, will cost about $225,000.

The Home Telephone Company will build an independent telephone exchange in Toledo, O., and it is backed by Brailey & Barber, of Wauseon, and Parks & Foster of Elyria, well-known independent telephone promoters, It is stated the company will be capitalized at $2,500,000, and the actual cost to the stockholders will be $650,000. It is said that the company has already secured about 5,000 subscribers, which at the lowest rate of $24 per year would yield $120,000 per year to start with.

At a recent meeting of the board of directors of the Dubuque, Ia., Telephone Company it was stated that it would be necessary to increase the facilities of the switchboard, owing to the increasing patronage of the company. It was therefore decided to add 300 new numbers, and the work will be completed within the next two months. The company has decided to make a number of other improvements, and now has men at work on some of them.

Chancellor Magie made an order last week for the sale of all property of the Home Telephone Company of Trenton, N. J., in the foreclosure proceedings instituted by the Morton Trust Company of New York. The telephone company was recently absorbed by the Interstate Telephone Company, which will be the purchaser. The trust company holds as trustee three hundred $500 bonds of the telephone company.

The Winchester Telephone Company, whose line extends through Baltimore, Md., has been sold to a Pennsylvania syndicate composed of Messrs S. L. Jones, H. N. Gett, G. D. Gett and T. J. O'Neill, of Hanover, Pa. The line extends over territory in Virginia, West Virginia and Maryland.

The United Telephone & Telegraph Company has obtained control of the Southern Telephone Company, which operates a system in Cumberland, York, Adams and Franklin Counties, Pa. The acquired lines will be connected with the system now controlled by this company, and which includes the Schuylkill Telephone Company of Northumberland County.

Plans and specifications have been completed for the large new telephone exchange building to go up for the Keystone Telephone Company at 231, 233 and 235 North 16th street, Philadelphia. It is to be built at a cost of $51,000. Specifications call for passenger elevators, steam heating, electric lighting and hard-wood finishing.

The Sunset Telephone & Telegraph Company has begun improvements on its system in Everett, Wash., at a cost of $10,000. All old wires and leads are to be removed and replaced with new material. From the central office cables, called the dry core paper cables, will be stretched to different points.

The Home Telephone Company of New Albany, Ind., has purchased the plant at Sellersburg of the Sellersburg Telephone Company, including an exchange of 100 'phones. The plant is one of the best of its size in Southern Indiana.

The Owenton & Williamstown Telephone Company has completed its line from Falmouth to Boyd, Ky., which gives Falmouth telephone connection with all the towns in Central Kentucky.

The Empire State Telephone Company has set poles for a telephone line between Mexico and Oswego, N. Y. The wires will be put up later.

W. L. Wray, of Brandon, Tex., is erecting a barb-wire telephone line from that place to Bynum, a distance of eight or ten miles.

The Richmond, Va., board of aldermen lately passed an ordinance granting the Southern Bell Telephone Company a franchise to do business in that city.

TELEPHONE INCORPORATIONS.

The Southern Union Telephone Company, Anna, Ill. Capital stock, $10,000. Incorporators: Thomas N. Perrine, Ed. Samson, and F. W. Willard.

The Cincinnati Telephone Company, Cincinnati, O. Capital stock, $10,000. Incorporators: Peter Nodler, Joe H. Becker and Charles H. Trome.

The Woodstock Exchange & Telephone Company, Woodstock, Ill. Capital stock, $20,000. Incorporators: Charles H. Donnelly, George W. Field and David R. Joslyn.

The Eel River Telephone Company, North Manchester, Ind.—to operate telephone lines and exchanges in Wabash, Whitley, Huntington, Kosciusko, Miami and Fulton. Capital stock, $10,000. Directors: Aaron A. Ulrey, Benjamin Oppenheim, Lewis Signs, Dayton C. Harter and Jesse J. Tyler.

GENERAL ELECTRICAL NEWS.

Lighting.

Chicago, Ill.—Architect M. Spitzer has completed plans for an electric light plant to be built in connection with a pumping station at Norway, Mich., to cost $22,000.

Columbus, O.—Sealed proposals will be received by the board of public works of this city at its office in the city hall building until 12 o'clock noon, September 27, and they will be opened at 2 o'clock P.M. same day, for lighting the streets, alleys, avenues and other public highways and places of the city for a period of one year from date of contract, by electric arc lamps, on a basis of from 650 to 700 lamps, as per specifications on file in the office of the director of public improvements. Clarence M. Addison, clerk.

Cripple Creek, Col.—At a meeting of the board of aldermen the granting of an electric light franchise to E. E. Wade of Colorado Springs was carried.

Delavan, Wis.—The Elkhorn and the Delavan councils are debating on an electric light franchise.

Franklin, N. C.—An election has been called to vote on issuing $30,000 of bonds for the construction of waterworks and an electric light plant. W. H. Macon is mayor.

Georgetown, Md.—A movement is on foot for the construction of an electric light plant and water works. The town clerk can give information.

Greenville, Ala.—Wm. C. Porter, of Laurel, Miss., has a contract for the electric light plant for this city; about $13,000 will be the cost.

Hazlehurst, Miss.—Wm. C. Porter, of Laurel, will prepare plans and specifications for this city's proposed waterworks and electric light plant. About $35,000 will be available.

Hempstead, Tex.—W.H. Freeman and associates are the parties here who will install an electric light plant.

Henderson, N.C.—It is rumored that an electric light plant will be built, and that N. W. Girdwood of Columbus, Ga., is interested.

Jacksonville, Fla.—This city will appropriate $27,500 for renewing and extending the electric light plant destroyed by fire recently. P. A. Holt, acting mayor.

Jackson, Mich.—The electric light and power commission has decided to abandon its flat rate and insist on the general installation of meters in the buildings of all light consumers, the power business remaining on the present basis.

La Salle, Ill.—This place is to have a new electric and gas light plant. The company is to be known as the Enterprise Heat, Light & Power Company, and it has a capital stock of $25,000. Geo. A. Wilson is president.

Lehigh, I. T.—John R. King, of New Albany, Miss., is in Lehigh with a view to putting in an electric light plant.

McIntosh, Minn.—The village council has granted to Anton Jensen a ten-year franchise for putting in an electric light plant to be completed by January 1, 1902.

McRae, Ga.—This town will vote on the construction of waterworks and erection of electric light plant. Address town clerk.

Montague, Mich.—The citizens will vote presently on the question of an electric lighting plant.

Mooresville, N. C.—The construction of waterworks and an electric light plant is talked of; probably the town clerk can give information.

Shawnee, Okla.—The Shawnee Electric Light Company has bought machinery to double the capacity of its plant and will install it at once.

Slater, Mo.—This place will soon have a new electric light plant.

Slate Run, Pa.—Electricity will be used to light this town.

St. Clairsville, O.—The citizens of this place have voted to issue bonds for improvements to the electric light plant.

St. Joseph, Mo.—This city will enlarge the capacity of its electric light plant for additional street lights. W. C. Stewart, city electrician.

Thomaston, Ga.—This city will erect an electric lighting plant after plans and specifications by Collier & Brown, 1112 English-American Building, Atlanta.

Wetumpka, Ala.—A company has been formed here for the purpose of providing electric light, and the stock is being rapidly taken.

Street Railways.

Beaumont, Tex.—Another Company has been organized to build an electric railroad in this city and its suburbs, and has applied for a franchise to the city council. Among those interested are Edward Kennedy and A. C. Rush.

Coldwater, Mich.—The electric railway company, in which Alfred Milnes of this place is interested, was recently granted a franchise by the Hudson common council.

Detroit, Mich.—R. F. Hannemann, of this city, has been for some months in Birmingham, Ala., engaged in promoting electric lines in that region. A Southern journal recently announced that the Steel City Railway Company with a capital stock of $500,000 had been chartered for the purpose of constructing electric lines in the suburbs of that city and that Mr. Hannemann was interested.

Fishkill Landing, N. Y.—A contract has been awarded by the Mount Beacon-on-Hudson Association of this place to the Otis Elevator Company of Yonkers to construct an incline railroad on Mount Beacon of the Fishkill range of mountains. The mountain is over 1,400 feet high. The incline road will be half a mile long. It will connect with the trolley railroad which passes through this place and Matteawan. The contract calls for the completion of the new railroad in four months. Electric power will be used and the best plant money can buy will be installed.

Florin, Pa.—Application for a charter for a trolley road between here and Middletown has been filed.

Lancaster, Wis.—A project is on foot for an electric railroad from Dubuque to this place, which will pass through Hazel Green, Cuba City and Platteville.

Long Meadow, Mass.—The Springfield Electric Company expects to extend its lines to this place.

Millville, Pa.—The borough council has granted the right-of-way through this borough to the Bloomsburg & Millville Electric Railroad.

New York City.—A new trolley line under the title of the South Jamaica Electric Transportation Company is being organized. Some of the incorporators are James F. Tibbits of Syracuse, T. W. Mandover of this city and C. J. Shaw of Far Rockaway. The new line is to connect with the New York & Queens County Electric Railroad and the Rockaway Road.

Parnell, Mo.—There is talk of building an electric line from here to Maryville.

Parsons, Kan.—This place is to be connected by trolley line with Coffeyville, Cherryville, Oswego and Chanute.

Rochester, N. Y.—Charles A. Lux, representing the promoters of the proposed Rochester & Syracuse Electric Railway, has been granted a franchise by the board of trustees to construct a street railway through the village of Weedsport.

Steubenville, O.—An electric railway company, said to be the Wheeling Traction Company and the Steubenville, Mingo & Ohio Valley Traction Company, has been granted a conditional franchise from the Belmont County line to Brilliant.

St. Louis, Mo.—The St. Louis, Clayton & Western Railway Company, of which Lilburn G. McNair is president, has begun surveys for an electric railroad from the western part of Forest Park, near the Clayton road, to Clayton.

Watertown, S. D.—An ordinance has been introduced giving an exclusive street railway franchise to a company composed of Chas. Kreger, C. H. Myers and H. Walrath, authorizing them to construct and operate an electric line.

Winchester, Ind.—The Eastern Indiana Traction Company, headed by Peter Schwab of Hamilton, O., was lately granted a franchise to run tracks through this city.

Woonsocket, R. I.—There is talk of equipping the steam railroad from here to Pascoag with electricity.

Manufacturing.

New York City.—The Manufacturing Electrical Novelty Company of this city has been formed to manufacture and deal in electrical apparatus and electrical goods of all kinds. The capital stock is $10,000. Geo. Stein, Leopold Pollock and J.T. Booth are the directors.

Philadelphia, Pa.—The J. G. Brill Company, builders of electric cars, will establish a plant in England. G. Martin Brill, president of the concern, says: "It is our intention to devote ourselves exclusively to the manufacture of trucks for the British market. The equipment will be of American make."

Watonga, Okla.—The Watonga Electrical & Manufacturing Company, capitalized at $350,000, has lately been incorporated by John Q. Cronkhite, E. S. Wheelock and others.

Company Matters.

Muskegon, Mich.—Architects J. H. Daverman & Son, of Grand Rapids, have made plans for a brick factory and office building for the Shaw Electric Crane Company of this city to cost $8,000.

Syracuse, N. Y.—The Marvin Electric Drill Company of this city has increased its capital stock from $300,000 to $550,000.

West Chester, Pa.—The directors of the Sun Electric Supply Company have decided to erect a one-story brick building on the lot adjoining the new factory in which to do japanning and dyeing.

Power and Transmission.

Mexico City, Mexico.—A syndicate of New York capitalists has purchased the MacKenzie concession obtained from the Mexican Government for the purpose of supplying this city with water, and also for the purpose of developing electrical energy equal to at least 30,000 hp. This power will be conveyed by means of long-distance transmission and be used for street lighting, street railways, mining, smelting and other purposes in the city and adjacent towns. The water needed and to be supplied amounts to 40,000,000 gallons per 24 hours. Warren H. Loss of New York City will supervise this improvement.

San Bernardino, Cal.—Articles of incorporation of the Mentone Power Company, which purchased a power right in Mill Creek Canon, were filed recently. The capital stock is $500,000, and the directors are Wm G. Kerckhoff, E. A. Beck and others.

Automobiles.

Hartford, Conn.—The new auto-sweeper is to be manufactured by a Hartford Company, organized by W. L. Curtiss, bearing the title of the Hartford Motor Machine Company. It is organized under the laws of the State of Maine, with a capital of $250,000, of which $200,000 is paid in, the balance remaining as a treasury stock. Most of the stock is held in this city.

Hazleton, Pa.—H. A. Franz, of the Franz Automobile Company, who expects to establish his plant here, has been informed by the board of trade that if he can induce the capitalists to become interested in the proposition the board will be ready to do business with him. Mr. Franz will communicate further with the board.

Lansing, Mich.—The Auto-body Company is the name of a corporation organized by business men of this city to manufacture bodies for carriages and automobiles. The company will occupy the former plant of the Stone Lumber Company at North Lansing, and will begin operations at once. The officers of the company are: President, Lawrence Price; treasurer, E. S. Porter; secretary and manager, H. F. Bradner; additional directors: L. J. Driggs and H. E. Thomas, all of Lansing.

New Haven, Conn.—Mr. Fischer, of the Fischer Motor Vehicle Company of Hoboken, N. J., manufacturers of motor vehicles for business purposes, says that if suitable inducements in relation to a site here are offered, his company will erect a $100,000 plant and employ from 300 to 500 hands.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, September 23, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	33	36
Broadway and Seventh Avenue	100	240	245
Central Crosstown	100	266	280
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	180	185
Dry Dock, East Broadway and Battery	100	120	128
Eighth Avenue	100	390	405
Metropolitan Street Railway	100	166	166¼
Ninth Avenue	100	196	200
Second Avenue	100	215	218
Sixth Avenue	100	175	215
Third Avenue	100	120	120¼
Twenty-Third Street	100	390	410
OTHER CITIES.			
Albany United Traction	100	106	107½
Brooklyn City Railway	100	242	244
Brooklyn Rapid Transit	100	67	67¼
Baltimore United Railways, com	50	16½	16¾
do. do. do. pref	50	91	92
Buffalo Railway	100	110	111
Cleveland City Railway	100	120	121
Cleveland Electric Railway	100	87½	88⅜
Columbus (O.) Street Railway	100	47	50
Jersey City, Hoboken and Paterson	100	20	23
New Orleans City Railway, com	100	28	30
do. do. do. do. pref	100	101	105
North Jersey Street Railway	100	22	24
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	31	32
do. do. do. pref	100	86	87
St. Louis United Railways, com	100	26¾	27¼
do. do. do. pref	100	89½	90
Detroit United Railway	100	74⅞	75¼
PHILADELPHIA.			
American Railways	50	40¾	41
Citizens	50	359½	360
Columbus Railway	100	40	40½
Columbus Railway, pref	100	84½	85
Consolidated Traction of New Jersey	100	67¾	68
Continental $29 paid	50	155	155¼
Consolidated Traction of Pittsburg	50	24	24½
do do pref	50	62	62½
Dayton Traction	100	156	156¼
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22¼
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151¼
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	95½	96
Railways Company General	5	2⅝	2¾
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5 6 paid	50	240	245
Union Traction, $17.50 paid	50	28⅞	29
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	178½	179
West End Street, com	50	94	94½
do. do. do. pref	50	112	113
CHICAGO.			
City Railway	100	205	210
Lake Street Elevated	100	13	13¼
North Chicago	100	190	200
Union Traction, com	100	16¾	18
do. do. pref	100	58½	85⅝

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	24	24½
do. do. do. pref	50	95¼	94½
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	49	50

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Electric Boat, com	100	16	20
do do pref	100	48	49
Electric Lead Reduction	100	2	2¼
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	4½	5½
do do pref	100	7½	8½
General Carriage	100	½	1
General Electric	100	261	261¼
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	250	251
General Electric	100	261	261¼
Massachusetts Electric Companies, com	100	36	39
" " " pref	100	91	91½
Westinghouse Electric & Mfg., com	50	72	72¼
do do do pref	50	80	80½
CHICAGO.			
Chicago Edison	100	167½	167¾
National Carbon, com	100	17¼	17¾
do do pref	100	84	84¼
PHILADELPHIA.			
Electric Company of America	50	7¼	7⅜
Electric Storage Battery, com	100	71	72
do do do pref	100	85	86
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	5⅜	5¾
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	93	94
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
BOSTON.			
American Telephone & Telegraph Company	100	163½	163¾
Erie Telegraph & Telephone Company	100	42	42¼
New England Telephone Company		135	135¼
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co	100	105	110
Commercial Cable Company	100	180	185
Franklin Telegraph Company	100	45	54
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	116	118
Mexican Telephone Company	100	2	2¼
New York & New Jersey Telephone Company	100	168	178
Pacific & Atlantic Telegraph	25	78	85
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		91¼	92
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	116
Cumberland Telephone & Telegraph Co	50	136	140
Chesapeake & Potomac Telephone Company	100	67	70
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		75	76
Hudson River Telephone Company	100	115	120
Northwestern Telephone Company, guar	50	122	126
Providence (R. I) Telephone Company	50	97½	98
Southern New England Telephone Company	100	..	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Sept. 23

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1¼	1½
Eddy Electric Manufacturing Company	25	10	10¼
Storey General Electric	10	11	12
Consolidated Car Heating	100	55	57
Standard Underground Cable	100	218	220
Pratt and Whitney, pref	100	87	88

STREET RAILWAY BONDS.

ALBANY.	Last Sale.	Int. Paid.
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96¾	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅝@16¾c.; Lake, 16¾@17c.; casting, 16¼@16¾c.

Control of the Johnstown, Pa., Passenger Railway has changed hands at 150.

The Westinghouse Electric Manufacturing Company dividend is payable October 1.

New York elevated roads are making large gains in traffic and earnings show a surplus over dividend requirements.

The project for a through street railway line from Hartford to Worcester, sixty miles, and ultimately to Boston, is making progress.

An official of the Chicago Edison Company says the month of September will show abnormally large gains in the output of electric current.

The Metropolitan Street Railway Company of New York has declared the regular quarterly dividend of 1¾ per cent., payable October 15.

The Electric Storage Battery Company has declared a dividend of 1¼ per cent., each, on its common and preferred stocks, payable October 1.

At the recent annual meeting of stockholders of the American Railways Company in Philadelphia the retiring board of directors was re-elected.

The Hudson & Bergen (N. J.) Traction Company has been formally merged into the Jersey City, Hoboken & Paterson Street Railway Company.

The American Electric Company of New York City, capital $1,000,000, has been incorporated to manufacture a patented substance resembling mannite.

The Erie Telephone problem is bothering the financiers in New York and Boston. The regular quarterly meeting of the directors will be held to-day (Wednesday).

The American Telephone & Telegraph Company has declared the regular quarterly dividend of 1½ per cent., payable October 15. Books close October 1 and reopen October 14.

The Metropolitan West Side Elevated Railroad (Chicago) traffic for the first twenty days of the current month shows a gain approximating 10 per cent., compared with the same period last year.

The Twin City Rapid Transit Railway Company reports for the month of August gross earnings of $283,589, an increase of $28,853, and net $161,554, an increase of $12,056; surplus $86,204, an increase of $5,990.

Mr. Walter Abbott has resigned as treasurer of the Erie Telegraph & Telephone Company and the subsidiary companies, owing to pressure of other business. Mr. John Balch has been appointed treasurer in his place.

The Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company of New York City, reports for the year ending June 30 gross earnings of $697,749, an increase of $357,236, and net $225,214, an increase of 298,783.

The franchises of the Chicago surface railway companies, based on the detailed figures of construction of the North, South and West Side lines, as summarized by a local publication, are valued at $75,000,000. The companies voluntarily opened their books for this unofficial inspection.

A mortgage for $1,200,000, given by the Ballston (N. Y.) Terminal Railroad Company to the Atlantic Trust Company of New York, has been executed and recorded in the Saratoga County Clerk's office to cover the same value of bonds issued to extend and equip an electric railway from that place to Amsterdam before December 1, 1901.

A drop of about 10 per cent. on Monday in the market value of the stock of the Amalgamated Copper Company—the Copper Trust—a shrinkage of over 15 points in two business days, created a sensation in Wall Street. A report was current on Monday to the effect that in order to relieve the situation and to dispose of surplus stocks the price of copper will be reduced 2 cents a pound. This could not be confirmed.

Stockholders of the Union Traction Company of Philadelphia, held their annual meeting on the 18th inst. The following directors were elected: Thomas Dolan, William L. Elkins, Alexander M. Fox, John B. Parsons, William H. Shelmerine, Alfred Smith, J. J. Sullivan, P. A. B. Widener, George D. Widener, George W. Elkins, Alexander Balfour and Charles O. Kruger. The report for the year showed: Receipts, $13,431,680.58; cost of operation and fixed charges, $12,570,414.14; net profit, $861,266.40.

Phelps, Dodge & Co., of Boston have this to say regarding the present copper situation: "During the past few months we have found the demand for refined copper to be unusually heavy. We are sold up two months ahead, and orders continue to come in in unusual volume. Shipments during the first two weeks in September have been as heavy as ever before in our history. Our price for electrolytic copper is 16¾ cents per pound, which is as high as it has sold this year."

The Commercial Pacific Cable Company was incorporated, with a capital of $100,000, at Albany on Monday. The incorporators are John W. Mackay, Clarence H. Mackay, Edward C. Platt, Albert Beck, George G. Ward, Albert B. Chandler and William W. Cook, all of whom are directors or officers of the Mackay Postal Telegraph and Commercial Cable Companies. John W. Mackay said yesterday that the Commercial Pacific Cable Company was organized to lay a submarine cable from California to the Philippine Islands by way of Honolulu, Hawaiian Islands. The cable will be about 8,500 miles long. The section from California to the Hawaiian Islands, Mr. Mackay expects, will be in operation within nine months. The time required to lay the cable from the Hawaiian Islands to the Philippine Islands will depend upon how quickly the cable can be manufactured, but Mr. Mackay believes the whole cable will be completed within two years.

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EDITORIAL NOTES.

The Copper Situation. Much interest is being manifested just at present in the copper situation. The attention of the financial world to the condition of the copper trade was focused by the action about ten days ago of the Amalgamated Copper directors omitting to declare an extra dividend, which practically reduced the dividend rate of their securities from an 8 per cent. basis to 6 per cent. It was explained at the time that the directors deemed their action a conservative one in view of the conditions of the trade, but no statement was given out in which the actual trade conditions were revealed.

The paramount questions would therefore seem to be: "Will the price of copper drop to around twelve cents?" or "Will the Amalgamated Copper Company be able to keep the price above sixteen cents?" Apparently widely diversified opinions are held in regard to these questions.

It can be authoritatively stated that the Amalgamated interests believe that the price can be maintained as a result of the sound condition of the copper trade in the United States. On the other hand, the opinion of copper brokers and dealers is that the condition of the trade abroad will necessitate a reduction here, and that it will come slowly. They believe there will be no sharp reduction, but that concessions will be offered from time to time.

According to the New York "News Bureau" prominent interests in the copper trade assert that an excessive surplus of copper does not exist in this country. It has also been asserted that the domestic consumption of copper thus far for the present year has been very large.

On the other hand it is stated by excellent authorities that the visible supply of copper in this country is very large. The copper production in the United States, as given by the producers, from January 1 to August 31 of the present year, amounted to 178,046 long tons. The figures for the same period of 1900 were practically identical, being 178,656 tons. The production for this period of 1900 was considerably in excess of that for the same period of 1899 and the output for the entire year was regarded as unusually large.

With respect to the statement that the domestic consumption of copper has been large this year and that it is increasing rapidly, it is stated on high authority that the consumption for the year to date has been about the same as that of last year, but it is postively asserted by many persons that no increase has been shown and that the record for the entire year should be regarded as satisfactory if it equals that of 1900.

Exports of copper for the present year to date are authoritatively stated to be about 50,000 tons less than for the same period last year, while the imports of copper for the present year to date have increased about 15,000 tons. This means a loss over last year's business of something more than $20,000,000.

With respect to the statement that the Amalgamated Copper Company does not intend to reduce the price of copper the opinion is expressed by well informed persons that the company must reduce the price of its product eventually if it wishes to dispose of its holdings. The same authorities say that copper can be imported from Europe and refined and be sold at a less figure than the Amalgamated Company is now quoting. It is even claimed that imported copper could be sold at several cents below the Amalgamated's price.

It has been said that the Amalgamated Copper Company controls such a large part of the world's output of copper that it can practically control the price of the product. In this connection an authority says that the world's output of copper last year was about 460,000 tons. Of this amount the United States produced about 250,000 tons, and of the American product the Amalgamated Copper Company supplied not more than 150,000 tons. It is pointed out, therefore, that the latter company does not control the copper output and cannot control the price.

It is generally agreed that the accumulation of copper by the Amalgamated Copper Company and its allied interests, is due not to any falling off in domestic consumption, but to the collapse of industrial activity in Germany, as well as other European countries. On the one side, those who believe a break in prices here is imminent maintain that the demand will not spring up abroad soon enough to warrant a maintenance of present prices until that period is reached. On the other side, the belief is firmly entertained that this demand is already beginning to show itself, and that, as the supplies are in strong hands, it will be an easy matter to hold prices up to the present figures.

* * *

Interurban Railways as an Investment. Mr. Guy Morrison Walker has written an interesting article for the New York "Financier" on the contest between steam and electricity, and his investigation has convinced him that the "building of steam roads will from this time decrease, and the great supply of steam road securities that has satisfied the investment demand of the past will diminish, while in their place will be offered for some years to come an increasing volume of the securities of interurban electric railways." This fact, he says, should lead trust companies, bankers and investors generally to investigate the intrinsic value of the securities of the interurban railways now in operation, and to discover if possible something to their future by investigating the conditions under which they are now competing for traffic in their respective territories. He also makes the point that the earnings of interurban lines are not so quickly nor so severely affected in times of industrial depression as are the earnings of the steam roads. The reason for this is easy to see, for when people begin to economize they naturally first curtail those disbursements which are heaviest, and as the steam road fares usually amount to considerable sums, their payment is heavy and is early cut off, while the fares of the interurban road, being small and light in comparison with the steam road fares, are hardly felt, and, as a consequence, traffic on interurban roads continues heavy long after a considerable shrinkage has been noticed in the travel over steam lines.

In Mr. Walker's opinion the electric lines will be forced into the carriage of freight and express, and that it will in their case, as it has been in the case of the steam roads, prove to be the most profitable branch of their traffic. The possibilities of the development of this class of business when the electric lines shall have been connected into systems, and when their roadbed and equipments are standardized so that they will be enabled to exchange traffic with steam roads, are so great that it is idle to speculate concerning them.

So firmly convinced has Mr. Walker become in the bright future of electric railways that he considers it exceedingly strange that the securities of interurban roads should have escaped as they have the attention of conservative and far-seeing investors, for with a capitalization averaging per mile so much less than steam roads, with earnings that compare favorably, with operation still crude, yet already at a far lower per cent. of gross earnings than the steam roads have been able to operate for, with rates quite profitable, yet far below the figures found unprofitable by the steam roads for the same class of traffic, it is impossible to escape the conviction that the securities of electric interurban roads are intrinsically a better investment than those of steam roads, and when the great undeveloped possibilities of their freight and express traffic are considered, then is one forced to realize that while the great growth in value of steam railroad securities has come to an end, the growth in electric railroad securities has only begun.

The Rapid Transit Power House. Work on the rapid transit subway in this city is rapidly progressing, as testified to by the numerous excavations open in all parts of the metropolis. About one-fourth of the total work to be done is already completed, the amount of money so far expended being $8,500,000 As the construction is being pushed so rapidly—namely, at the rate of $1,000,000 a month—steps are being taken looking to the erection of a suitable and centrally located power house. With this object in view the entire block bounded by Fifty-eighth and Fifty-ninth streets and Eleventh and Twelfth avenues, was purchased last week by John B. McDonald for the Rapid Transit Commission.

Plans for the placing of the machinery which is to drive the rapid transit system had been made before a search was begun for the ground on which to build the power house, and it was known that a plot of land 600 feet long by 200 feet wide would be needed. The property just purchased is 800 feet in length and 200.10 feet wide, thus affording more than 160,000 square feet of floor room, which will be ample.

In addition to filling the requirement for space, the property acquired fronts on the North River, thus affording excellent docking facilities, which are also necessary. There is at present a pier 250 feet long on the property, and this is included in the sale with all riparian rights. This dock, however, will not be sufficient, and an additional 250 feet will be added as soon as practicable.

It is expected that work will be begun on the power house in about six months.

Mr. Douglas Robinson, who acted as sale's agent, referring to the subject is reported as saying:

"We feel entirely satisfied with the purchase because we have a plot on which we can place a building, such as it is proposed to erect, that will be seen by everyone going up or down the Hudson River. It is the intention of Mr. McDonald to have a building that will be an ornament to the city and one that will be entirely satisfactory to the citizens of this great metropolis. It will also be the largest structure of its kind in the world, and undoubtedly will contain the most powerful machinery."

While plans for the building have not yet been decided upon, it has been estimated that it will cost, when completed and furnished with the necessary machinery, nearly $3,000,000.

Contracts have already been let a Milwaukee company for eight engines of 7,500 horse power each and the Babcock & Wilcox Company for forty-eight water tube boilers. There are yet many contracts to be given out, among which are those for furnishing the electrical machinery and apparatus, which it is understood will be awarded in the very near future.

◆

Consul Warner reports from Leipsic, Germany, that work has been begun on the electric railroad between Halle and Merseburg, permission for the construction of which was granted by the Prussian Government several months ago. It is expected that the Halle-Amendorf section will be completed before the beginning of winter. The total length will be 10 miles. Power will be obtained from the River Saale. The Consul also states that the projected electric railroad between Leipsic and Halle has been abandoned, the Prussian and Saxon Governments having refused to grant the necessary franchises.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

An unusually large attendance is expected at the Convention of the American Street Railway Association, to be held in this city October 9, 10 and 11. Western men are coming in large numbers. A special train will leave Chicago on Monday next at 3 P. M. under the personal charge of Mr. N. C. Keeran, passenger agent of the Wabash road in Chicago. The headquarters of the Association in New York will be at the Murray Hill Hotel.

◆

Charles T. Yerkes has bought another London railroad, or, rather, he has contracted for 999 years with the Great Northern Railway to take over its suburban business and franchise for the projected underground road to extend from Holborn to Finsbury Park. Parliament will be asked to grant a franchise for a link, less than a mile long, to connect this line with Mr. Yerkes' Brompton and Piccadilly line. Both lines connect with the District Underground Railroad, giving Mr. Yerkes control altogether of 46 miles of road.

◆

Before the end of the year sleeping cars will be put in operation on the trolley line of the Lake Shore Electric Company. The sleepers will run on the line from Detroit, Mich., to Cleveland, O., and possibly to Toledo. Through trains with sleepers will run between Cleveland and Detroit, it is promised, by Christmas. This will be the longest electric road in the world when completed from Detroit to Pittsburg.

◆

It is stated that the first cable for a telephone line between Brussels and London was laid September 27. The distance is 250 miles, 56 of which is under water. The cost of the construction of the line will be £36,000.

◆

Electricity has become an important factor in the economics of mining. It has made possible the working at a fair profit of ores of too low a grade to work with the use of any other form of power. Many mines which could not be formerly worked are now included in the list of paying properties, owing to the application of electricity. The field for its employment is broadening monthly, and the resources for its development are as yet barely touched.

◆

Mr. Joseph M. Hill will be associated with Mr. Thomas A. Edison in the development of the commercial side of the Edison storage battery.

◆

A study of electrical railway systems in Europe is to be made before the Rapid Transit Commission and the company having the contract for the rapid transit tunnel in this city decide upon plans for operating the cars in the tunnel. William Barclay Parsons, the chief engineer of the Rapid Transit Commission, will sail on the Deutschland to-morrow to begin an examination of electrical railways. He will meet in London August Belmont, who financed the tunnel company, and some other men interested in the tunnel. Mr. Parsons will spend at least a week in London examining the underground roads in that city. After Mr. Belmont and the others join him in London the party will go to Paris and spend another week examining electric roads and electric plants there. Later they may visit some other cities on the Continent. Mr. Parsons said he expected to return in a month.

◆

The value of the wireless telegraph at sea was recently demonstrated when the Campania and the Lucania passed one another in mid-ocean. They were able to communicate with each other for a hundred miles. Each signaled the other about the sighting of icebergs before they sighted each other, and when they were 35 miles apart.

◆

The building of the Cape-to-Cairo telegraph line has offered plenty of opportunity for the inventive mind. Difficulties of transport have perhaps never before been so keenly experienced, and have forced the engineers to fall back on many devices of their own in the absence of regulation material. Live trees now take the place of telegraph posts, and, according to a Cairo correspondent, they offer more than one advantage over the dead-wood uprights. In particular, they afford protection against the swarms of white ants which infest the country. From time to time the branches are kept lopped sufficiently to preserve the wires from being too much enveloped in foliage. Cords of tarred hemp are used as insulators.

◆

The first call for bids for motor vehicles to be used in the Postal Service was made in an order of the Post Office Department at Washington, D. C., September 27. Bids are to be opened there on October 12 for furnishing five vehicles for service at Minneapolis, Minn. The vehicles are to weigh not less than 1,000 pounds each. They will be used from January 1, 1902, to June 30, 1903, with a running time not exceeding sixteen hours a day. Wagons, messengers, and electric cars, now carrying the mails in the area covered, will be supplanted for the time named. The plan is merely an experiment as to the feasibility of such service generally. The vehicles will not be used for collections.

◆

A process has been discovered in France by which garbage is converted into briquettes. It consists of mincing the refuse from abattoirs, fish markets, etc., straw, paper, and the like, and adding tar and naphthalene. The whole mass is then mixed in a kneading apparatus, dried and pressed into briquettes. The director of the Paris Municipal Laboratory says: "These briquettes have a slight odor of gas, burn brightly, and engender heat slowly. With a more highly perfected method of manufacture, they will engender less ash, and the heat-producing qualities will be about the same as those of common coal. They will also possess the advantage of burning slowly and developing no smoke."

◆

The extent of dredging for gold, which is being carried on in the bed and on the banks of the Feather River below Oroville, Cal., is indicated by the amount of electric power which is being used to drive the various dredging machines. For the past 18 months or more the Bay Counties Power Company, whose two power houses are located at and 10 miles above Colgate, on the South Yuba, supplied these machines with 1,000 horse power. This will soon be doubled. The amount of electrical energy which these Feather River dredges will soon be employing will thus nearly equal the horse power energy drawn by the Grass Valley mines from the same works. The latter are using 2,500 horse power.

◆

On account of the advent of electric railways in Bombay and Calcutta, India, fresh sites had to be found for the magnetic observatories, and the observatory in Rangoon is to be located far out of the town.

◆

The hugh machines called for to equip the Metropolitan Electric Lighting plant at Willesden, one of the suburbs of the British metropolis, will be manufactured by Continental European concerns. The two engines of 6,000 indicated horse power each will be built b the Swiss engineering firm of Sulzer Bros., while the same number of 3,500 generators will be manufactured by Kolben & Co., of Prague, Bohemia. The combined value of these orders exceeds $350,000.

◆

The first electric railroad in Russia has been opened this year; it is 13½ miles long, and connects the manufacturing city of Lodz, in Russian Poland, with the neighboring towns of Zgierz and Pabianice.

◆

The Cape Breton, N. S., Electric Company is installing searchlights for its ferry boats plying between the Sydneys.

◆

At Rouen, France, the chief of the fire department has submitted a proposal to the municipal authorities on the subject of utilizing the tramway trolley wires in connection with the extinguishing of fires. All the principal thoroughfares of the town are provided with electric tramways, and the proposal is that pumps capable of being electrically driven should be installed in a number of suitable positions on the tramway route, to be switched on to the trolley wires, so that the pumps can be used as occasion necessitates. The proposal is said to have been favorably received and is now under the consideration of the authorities.

◆

Probably for the first time in the history of Maine logging electricity will be used this winter in the transporting of logs from the woods to a river landing. An electric traction engine is now being constructed for use on a tract of land in the Dead River region.

◆

An installation for the transmission of electrical energy has just been completed near Naples, in the Valley of Pompeii, in which all the conductors used are of aluminum, says the "Electrical Engineer," London. This installation consists of three horizontal turbines of 150 hp. working at 190 revolutions per minute. Each turbine drives a three-phase alternator, and the current at a tension of 3,600 volts is led along three aluminum lines to Pompeii, Sarno and Torre dell' Annunziata. The first of these lines is about two miles long, and leads to a sub-station of two, 3-phase transformers. The second line, leading to Sarno, has a length of about 10 miles; it conducts the current to a three-phase motor working at 3,500 volts and driving a continuous-current dynamo of 36 kw. capacity. This installation supplies a three-wire system at 240 volts. The third line, to Torre dell' Annunziata, is over two miles long, the current serving for motive power in the neighboring macaroni factories.

DEVELOPMENT OF THE NERNST LAMP IN AMERICA.*

BY ALEXANDER JAY WURTS.

(Concluded from page 180.)

Explanatory Notes.—The Hefner unit of candle power has been adopted in this paper so that ready comparisons may be made with results obtained on the Nernst lamp in European countries.

Names of Parts in the Nernst Lamp: The "glower" is the filament or light-giving body. The "ballast" is a steadying resistance connected in series with each glower. The "holder" is the removable piece containing glowers and heaters. The "heater-porcelain" is the porcelain disk in the holder immediately back of the heater. The "heater-case" is a small glass globe used in the six-glower and thirty-glower lamps.

Performance of the Lamp.

At the present writing, July 15th, there are in operation at East Pittsburg, 73 six-glower lamps, one three-glower and three single glower; in our laboratory and shop at Allegheny, 40 six-glower, 10 three-glower, and 21 single glower lamps; in the courtyard we have four outdoor six-glower lamps and in the tumbling room of the foundry, one outdoor six-glower lamp, all running on alternating current at 220 volts. In addition to these, there are 14 single glower direct current 110-volt lamps in Mr. Westinghouse's residence, making a total of something like 50,000 candle power in and about Pittsburg. At the Pan-American Exposition, we have lighted the interior of the dome of the Electricity Building by festooning 92 six-glower lamps from a pendant chandelier consisting of a central lamp of 30 glowers and 2,000 candle power encircled with six lamps of the six-glower type; on the floor, variously distributed, there are 12 six-glower, 24 three-glower and 8 one-glower lamps. These figures are intended to give some idea of the scale on which the Nernst lamp has been developed and the resources which have been placed at our disposal.

Seventeen six-glower lamps have been running at East Pittsburg for more than a year, and are now showing an average life of 800 hours per glower. A similar record has been made with 14 six-glower lamps operating in Allegheny for about a year and a half. The four outdoor six-glower lamps have been running every night during the last twelve months through all kinds of weather, and up to the present time have not given a moment's trouble. The six-glower lamp in the tumbling room of the foundry failed in the cut-out at the end of 1,000 hours owing to the accumulation of a bunch of iron dust on the pole of the cut-out magnet, but a few strokes of a brush removed the difficulty and the lamp was continued in service.

The line service to these lamps has been fairly good for a shop circuit. As a matter of record, however, it was decided to test 4 six-glower lamps on a circuit, having wide voltage fluctuations and to keep a record of the service and the lamp performance. The record follows:

Four six-glower, 220-volt lamps were run 1,000 hours. The run was continuous with the exception of three periods per day of one-half hour each when the lamps were turned off. A record of the voltage was kept with a Bristol recording voltmeter. An inspection of the voltmeter cards show that these may be classified under three types. Of the first, there were 15 cards, indicating that the voltage did not rise higher than 229 volts and only remained there for a short period. Of the second type, there were 26 cards, in which the voltage reached a maximum of 232 volts, maintaining this for about four hours. Of the third type, there were four cards showing a rise of voltage to 237 and remaining at 235 for five hours. These cards show that the lamps have been tested on a circuit, pressure of which varies from 4 per cent. below to 7½ per cent. above normal. There were no ballasts or heaters burned out during this run, nor did the lamps receive any attention or give any trouble.

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*Paper read at the 18th Annual Convention of the American Institute of Electrical Engineers, Buffalo, N. Y., August 23, 1901.

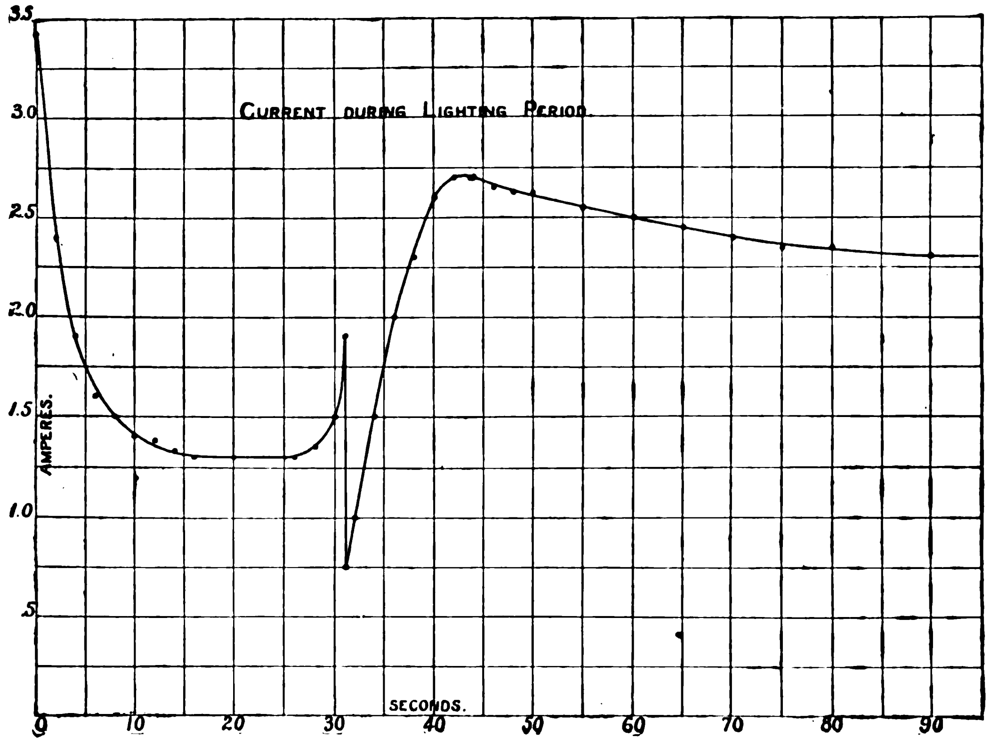

FIG. 10.

Of the 24 glowers in these lamps,

15 ran 1,000 hours;
6 ran 792 hours;
1 ran 580 hours;
2 ran 380 hours;

making an average of 890 hours.

The three, two and one-glower 220-volt, alternating current lamps have given equally satisfactory service, but the glowers in the 110-volt alternating current lamp are not quite so uniform in their performance and the same glowers on direct current are comparatively short lived, averaging in the neighborhood of 150 hours; 220-volt glowers, however, on a direct current circuit would last nearly double that time. At East Pittsburg, where a section of the factory about 350 feet long is lighted with 50 six-glower lamps suspended immediately above the traveling cranes, the features which strike me more forcibly than anything else are the beauty of the illumination and the total absence of shadow and flicker so intimately associated with the electric arc illumination in places of this character.

In connection with this topic, it will be interesting to note just what is going on in the lamp during the time of lighting, also during service under varying conditions of line voltage. Referring to Fig. 10, we have a curve showing the current taken by a six-glower 220-volt lamp during the lighting period. It will be noticed that as the current is turned on, there is a sudden rush of nearly 3.5 amperes through the heater, which, owing to the temperature correction of the platinum wire, is quickly reduced to about 1.3 amperes. At the end of 26 seconds, the first glower begins to light; at the end of 30 seconds, the second glower is lighted and the heater is cut out, the current dropping at once to .75 of an ampere; the remaining glowers then light rapidly until at the end of 40 seconds all the glowers are lighted. From this point on there is a slight drop in the current until the lamp reaches its normal running temperature.

Referring once more to Fig. 5, we find the current and voltage characteristics of the different elements in the lamp, and above these the characteristics of the lamp itself, the latter being the sum of the cut-out coil, the ballast and the glower. The lamp curve was taken from actual measurements and approximates very closely to the sum of the elements, the slight difference probably being due to some differences of temperature. The voltage scale for the cut-out and ballast curves will be found on the right hand side of the diagram; that of the glower and lamp on the left hand side. Your attention is now directed to the excellent characteristic of this lamp, and when we consider the severe conditions imposed by the glower characteristic, I think we are to be congratulated on the results which have been attained. With a normal in the lamp of 2.4 amperes and 220 volts, it will be noticed that an increase of 14 per cent. in voltage causes but a 10 per cent. increase in current, resulting in a comparatively steady light and safe running conditions for the lamp in commercial service. A rise of 25 per cent. in the line voltage would burn out the ballasts in a very short time, but a rise of 10 per cent. for short periods does not seriously affect the life of either glower or ballast; a rise of 5 per cent. may be considered allowable for indefinite periods.

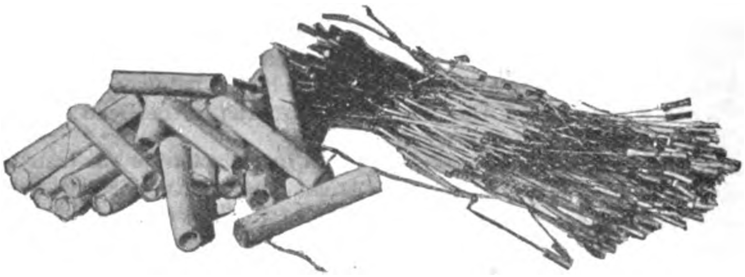

FIG. 11.—HEATER TUBES AND GLOWERS.

REPAIR AND MAINTENANCE.

When the lamps are first started, they require no attention. After 1,000 hours, however, the renewals become fairly regular and our experience shows an average life of 800 hours for the glowers, 2,000 to 3,000 hours for the heaters and an indefinitely long life for the ballasts. It will, however, be some time before the average life of the heaters and ballasts can be definitely determined. The attention which these lamps receive, consists in having the inspector examine the lamps once a week through a colored glass to determine whether or not all six glowers are burning. If two glowers are out, the lamp is turned off, the holder removed and two new glowers inserted; the holder is then returned to its place and the lamp continued in service. Aside from such renewals, these lamps have not given the least trouble.

On the occasion of starting up 50 six-glower lamps at East Pittsburg, one of the engineers who had had considerable experience with arc lamps, remarked that my troubles would now begin; but, frankly, I think he was mistaken. Aside from the renewal of the perishable parts, I see nothing in the lamp which could possibly cause trouble except under the most extraordinary circumstances. In fact, should a lamp receiving proper attention fail to light, I would look for the trouble elsewhere than in the lamp.

In commercial service it is intended that the central station shall make the renewals in the holders. The customer will be provided with a case containing a suitable number of complete holders, ready for service, so that when a renewal is to be made, the customer will simply remove the old holder and insert a new one, such operation consuming but a moment's time; then at convenient periods, the old holders will be exchanged for new. Where lamps are used in quantity, the renewals will probably be made by the local attendant. The replacing of a ballast requires the removal of the lamp from the circuit; but after that the renewal is easily and quickly made. A slight withdrawal of one screw releases the ballast tube from its socket, whereupon the small aluminum terminal plugs may be withdrawn and the new ballast inserted. This operation does not require any tools other than a pair of small tweezers, and the renewal can be made without returning the lamp to the workbench.

After about 100 lamp hours, the heater case becomes somewhat discolored, and, for first-class maintenance, this should be cleaned at the end of that time. The following instructions for the care and inspection of the Nernst lamps are observed at East Pittsburg:

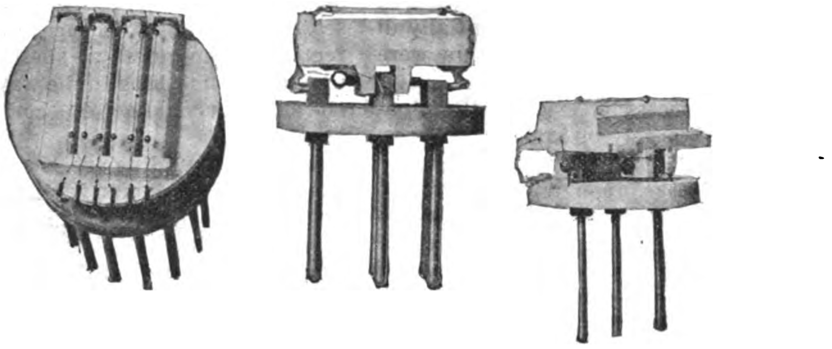

Fig. 12.
Holders for the six, two and three, and one glower lamps, showing an aluminum plug ready to be inserted.

Inspection of the Lamps.—The lamps should be inspected every 100 lamp hours. After being turned off, the lamp is turned on, and it is noted whether all the heater tubes become bright. If any of the heater tubes are burned out, the holder is replaced by a new one.

If the heaters are intact, the number of glowers burning is determined. If five or six are burning, the lamp needs no attention.

If less than five glowers are burning, the lamp is to be turned off, the holder taken out and the number of broken glowers determined by inspection. If the number of broken glowers is less than the number of glowers that were out, one or more ballasts are out of order and the lamp is to be taken down at once and the defective ballast replaced. When two or more glowers are burned out, the holder is to be replaced by a reserve holder.

Ballasts.—These are supplied in boxes marked "Ballasts for six-glower lamps," "Ballasts for one-glower lamps," etc. Burned out ballasts are to be renewed as soon as discovered and may be replaced without taking the lamp to the workbench.

Heater-Case.—This receives a coating of platinum black on the inside and should be replaced every 100 lamp hours by a clean heater case. The coating may be removed from the old heater case with a bristle brush running at a high rate of speed. The heater case may then be used over again.

Glowers.—These are supplied in glass tubes marked with the voltage of the lamp for which the glower is intended, thus, "Glowers for 220-volt, six-glower lamps." Glowers marked for six-glower, are not to be used in a three or one-glower lamp and vice versa.

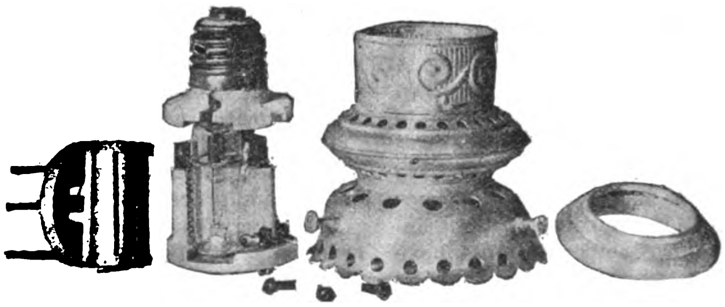

Fig. 13.—Parts of the Single Glower Lamp.

Heaters.—These are wound for 110 volts and are so marked. They are connected two in series for 220 volts. In the six-glower lamp there are four tubes connected in multiple series.

Heater Porcelain.—(This is the porcelain disk immediately behind the heater.) The heater porcelain is given a white coating which becomes fairly hard, but can be easily scraped or brushed off when it becomes covered with platinum black. When a holder with a black heater porcelain is removed, the glowers should be taken out, the old coat brushed off, except directly under the heater tubes, and a new coat of "heater porcelain paste" applied. This paste is a white powder which is to be mixed with water and applied with a camel's hair brush. After replacing the heater porcelain and allowing it to dry in the air, run the heater for two minutes on 220 volts, placing the holder in a heater case. This hardens the coating, after which the glowers may be replaced.

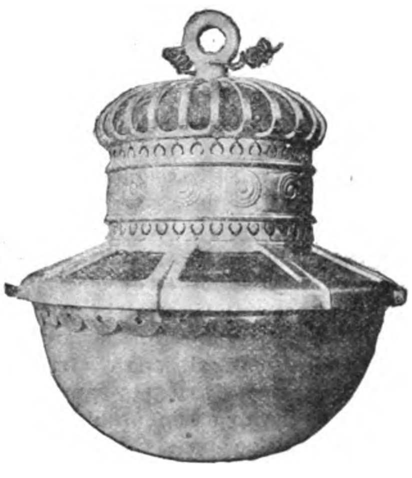

Fig. 14.
Thirty-glower lamp, indoor type.

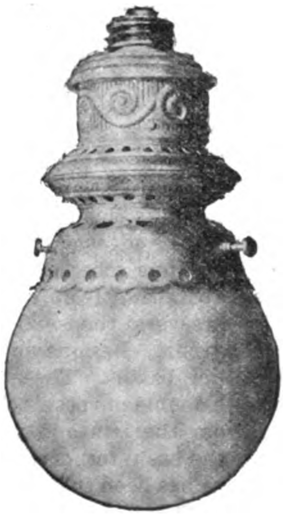

Fig. 15.
Single glower lamp, indoor type.

Cost.—It is too early to say anything definite about the cost of these lamps. Fourteen or fifteen dollars would seem to be a fair price for a six-glower lamp, other lamps in about the proportion of the number of glowers. It is estimated that the cost of renewals will be considerably less than for inclosed arc lamps.

Provision will be made for the return of the perishable parts containing platinum.

Conclusion.

In closing, let me say that the Nernst lamp can in no sense be considered an experimental device. The development of details connected therewith has continued until all question of doubt as to its commercial success has been removed by the operation of a large number of lamps of various sizes and finished pattern for extended periods under commercial conditions, and it is confidently felt that the splendid exhibit of these lamps which may be seen at the Pan-American Exposition will prove a fitting demonstration of the complete and thorough manner in which the brilliant discovery of Dr. Nernst has been taken up and pushed forward in America.

THE EVOLUTION OF EXPOSITION LIGHTING.*

BY LUTHER STIERINGER.

(Concluded from page 178.)

The popular impression derived from illustrations, sent out in advance, of the Electric Tower illumination, as it was expected to appear, was that it would be translucent and luminous, not unlike the miniature chalk towers with colored glass windows lighted from inside, on sale by Italian venders some years ago. If such a method had been possible with the Electric Tower, it would only have resulted in showing up the skeleton like a radiograph. The effect of translucency and a luminous appearance is however produced in an entirely different way by placing the light so as to secure a uniform illumination with all desirable points accentuated, thus securing the effect of being luminous by external brilliancy. The light background of the structure has more to do with heightening the brilliant effect than most people who witness it have any idea.

As electricity was the first medium to render comprehensive illumination of the grounds and buildings possible, it was but natural that impossibilities should be expected of it. The history of the Chicago World's Fair is full of vagaries and delusions that by turning on electricity the daylight might be loaded with rainbows and the night flooded with sunshine.

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*Paper read at the 17th Annual Convention of the Association of Edison Illuminating Companies, Buffalo, N. Y., Sept. 10, 1901.

Now nature not only forbids such extravagancies, but true art as well as expediency and cost condemns them. The first duty of an expert in lighting is to emphasize the fact that we can but secure relative effects, the harmony of which will accomplish infinitely more than costly and laborious sensationalism. To an eye that has been fixed on the sun the glow of the incandescent lamp is a sickly yellow and the beam of the arc a ghastly blue, but coming out of the darkness into a room properly lighted by incandescents we enjoy at once a feeling of cheerfulness.

In the case of the buildings and grounds the true principle is to outline and accentuate against the dark background of the night. Thus the imagination is given a chance and this freedom is pleasant to all intelligent minds. The spectator whose eye is not dazzled moves comfortably about and the expenditure of electrical energy for a given result in illuminating effect is minimized.

In planning the illumination of the main setting of the Pan-American all spectacular effect was barred. Paris suffered in its last two expositions from the introduction of spectacular fountain and illuminating features in its main court. When such are presented all surrounding illumination must be under control to secure proper contrast. The illumination of the water basins or lakes and fountains therein was first introduced by the writer at the Atlanta Exposition of 1895 by placing 60 incandescent lamps on floats encircling the outer edges of the falling spray from two pyramid fountains in one of the lakes. The next development of this feature was at Omaha in 1898 when about 200 incandescent lights were placed bordering the fountain "Nautilus" and so arranged as to appear as floating on the water and accentuating the edges of the water figures or splash. This same scheme has been followed on a more elaborate scale at the Pan-American, there being several thousand lights in the main fountain basin. Designs were also developed for the other basins. These were all designed to serve a double purpose, to light the water issuing from the jets and to illuminate the water in the basin for ornamental effect. Neither of these has been fully realized, the design of the water figures having been changed from the original plan, which would have given better results, as it harmonized with the water figures, the lights being more scattered and in sinuous lines. As it now exists it is faulty from being too concentrated. It is composed of rings concentric to each water figure. Between each set of circles is a filling of lamps intended to represent an arrowhead, but undistinguishable because on the plane of vision. The effect is one of mass without definite arrangement or purpose.

There are important periods in the electrical requirements of an exposition. First, the prospectus outlining the scheme and scope; second, development of plans; third, construction; fourth, operation. The two latter are hard to appreciate unless one is familiar with all the details, for upon their execution depends success.

The engineer who designs the illumination of an exposition has by no means an easy task. It is not simply a question of circuits, though that is no child's play, for a distribution to as many lamps as there are at the Pan-American, nor is it a question of placing a light here and there for immediate use. The expert on illumination must be able to see in the mind's eye the effect he will produce when the exposition is at a stage when the grounds are barren and the architectural features are but little further advanced than in sketches. The prospectus and preliminary report of the lighting of the Pan-American was of necessity prepared from such meagre data and yet substantially all the electric and fountain requirements were anticipated therein.

It may be said success in designing illumination must depend largely on artifice. It does, but not of the kind that betrays itself. The artist upon light looks upon any subject just as a painter does upon a landscape. He has to compose a perfect picture by means of the disposal of illumination and he must be judged by the resultant whole. For example, to erect huge wooden masts outside the buildings would dwarf the structures. To make each building a blaze of light would blot out the grounds. A sea of light in the paths and lawns would reduce the buildings to islands of darkness, so that the study of distribution and diffusion becomes for a lighting expert not only a severe problem, but a fascinating and absorbing pursuit. In dealing with questions of light for strictly utilitarian purposes, means must be adopted quite different from those that promise success in spectacular displays, but the result is ever a matter of guess-work. The experiment is much the same as firing of modern artillery. Each shot is so costly and so irretrievable when fired that native genius and prayerful study must be taxed to the full in advance to insure the hitting of the mark. It will be seen at once how extremely difficult it would have been to change the plan of lighting the Pan-American after adoption, and therefore, how much experience and forethought must have gone into it in advance.

I can do no better than quote from an article from Mrs. G. Van Rensselaer which appeared in the New York "World" of May 12th, 1901: "The effects of electric lights are indeed not artistic effects in one sense. But in another they are, for they are wrought by the hand of man, although with one of nature's own agencies, and they cannot be well exhibited except upon a fine architectural background. To speak accurately, they are decorative effects. This means that they belong to the category of the varied kinds of beauty that man has created, and they are the only kind that modern man has created without any help from precedent or tradition. Here we may say, with some self-satisfaction, is something extraordinarily beautiful, which the Greek and the Roman, the Frenchman who built Gothic churches and the Italian who built Renaissance palaces, had no chance to enjoy. Greatly our superiors in the production of beauty of many other kinds, here they were not even experimenters or prophets. A Greek or Roman could have no more imagined the nocturnal scene that we shall behold in the Court of Fountains at Buffalo, than a cave dweller or a man of the stone age could have imagined the daytime aspect of classic Athens or imperial Rome. On a moonlight night, indeed, the Rome of the emperors must have been an even more impressive sight than by day. But on a dark night it could not be seen at all. What did it have wherewith to illumine itself? Nothing but oil lamps, bonfires, torches, and on some great occasions, perhaps a few tar-smeared burning Christians.

"When the charmingly varied features of the big buildings at the Pan-American are defined and wreathed about with garlands of flame, when its hundreds of tall or spreading fountains and wide sheets of cascades shimmer with ever-shifting and varying colors, when its tall Electric Tower set with 40,000 lamps seems an almost solid sheet of flame, and its scores of searchlights turn and play in all directions, then indeed we shall realize that we have done something in the way of beauty that the ancients could not do—could not imagine as possible."

While the building art has derived expression from the ancients, yet in our time we have few new conceptions but many poor reproductions. The illuminating results achieved at the Pan-American are the work of the scientist, inventor and engineer, without whom the old vessel of fat, the source of light of our ancient friends, would still hold sway.

Lighting is not a matter strictly for architects nor engineers, but a special art and a subject of special investigation. Whatever beauty the architecture may possess, if a funeral aspect is to be presented on occasion, the mourning colors of the country must be chosen, be they white, yellow or black. If the occasion be festive and in daylight, bunting in the skilled hands of the decorators will secure a festive transformation. To make a scene festive at night, it can only be by the aid of illumination.

Interference or meddling before the completion of the original scheme of the electrical work was avoided as much as possible at the Omaha Exposition. No one other than the designer and constructor knew what to expect of the illumination until the first trial, which then proved satisfactory to the management as well as to the public. There was considerable meddling with the work in hand by outside influences at the Pan American Exposition and at the Chicago World's Fair. This resulted in the abandonment of many good features and the neutralizing of others. As an instance of this, a continual harping for gas torches along the canals (a repetition of an abandoned experiment at Chicago) resulted in their being finally introduced at the Pylon embankments. This is an age of electricity and we are not handicapped as Nero and the ancients were in their illuminations. There is another instance of suggestive meddling which appeared in a prominent New York daily among the art notes. Such suggestions, if backed up with influence, become disturbing. This shot at the Electric Tower read as follows:

"A dozen big ropes well studded with lights from the Electric Tower to convenient nearby points would add greatly to the effect without adding much to the expense, but some experience was necessary to teach the managers that a line of lights on a dark night looks just as well strung from a long rope or a pole as from a pile of masonry."

This same idea was carried out recently at the Twentieth Century celebration in Philadelphia and proved how not to do it.

In closing this paper a few remarks are in order on what the future may show in exposition lighting, if the experiences of the past are heeded. Experience has demonstrated that the future successfully illuminated exposition will use a small unit of light, well diffused and of pleasing color, the unit to be well distributed. All concentrated light will be avoided unless the concentration is accomplished with the smallest practicable unit so that the volume does not exceed the general intensity established. Especially is this essential if displays of emblems or other artistic creations are introduced. These must not mar the actual illumination. Where spectacular effects are desired they must be so related to the whole as not to become obtrusive. Light is only relative. The expert on illumination must ever remember this, and never spoil the beauty and efficiency of a general scheme by objectionable lighting which dwarfs all surrounding illumination.

MISCELLANEOUS NOTES OF INTEREST TO CENTRAL STATION MEN.—VII.

BY W. H. WAKEMAN.

We frequently find directions in the mechanical papers for reversing an engine. Almost invariably it is assumed that the valve gear is operated by an eccentric on the crank shaft, and the position of it must be changed. This is proper so far as it goes, but there are a respectable number or engines in use that cannot be reversed in that way. The Brown and the Putnam engines have valve gears driven by a gear on the crank shaft, which operates another shaft known as a side shaft, and this drives the governor and the valve gear.

This side shaft must revolve in the same direction regardless of the direction in which the fly wheel travels, consequently when it is desired to reverse one of these engines the bevel gear on the side shaft must be put on the opposite side of the gear which drives it, then the motion of the crank shaft will be reversed. This seems to be an awkward way to consider it, but the explanation is in the fact that in all such cases the governor should be regarded as the prime mover; then it will be clear that as it is to revolve in one direction only the bevel gear on the side shaft, near the main bearing, must be reversed if the fly wheel is to run in the opposite direction.

A man who claimed to have charge of a plant in a small town in Connecticut, while visiting in another place, was asked what kind of an engine he used, but could not tell as he had forgotten. I cannot imagine how a competent engineer, who is properly caring for a plant, can fail to know what kind of an engine he is running. A man who is really doing good work along this line becomes a part of the institution, therefore he should neither forget his own name nor that of his engine. One trouble with many of our engineers is that they persist in working from day to day without having any special interest in their plant. They work with their engines the same way as a pipe fitter works with his kit of tools which belongs to his employer, or the laborer with his shovel for which he is not required to pay, but they never have that keen interest in the machine they run which is a conspicuous part of the really competent engineer's stock in trade.

As an illustration of this point, I remember the case of an engineer who left his plant as soon as the day's run was completed, although some of the shop hands were going to lace the main belt that evening. He claimed to have no interest in the matter because the belt was outside of his jurisdiction, but in such a case his jurisdiction should have been extended without delay. He received very low wages and was dissatisfied accordingly. When another man who took more interest in the whole plant was placed in charge he received higher wages.

Does coke burn out a furnace faster than coal? Some firemen claim that it does, but what is the philosophy of it? Where steam is to be generated for a given load a certain amount of heat must be supplied, therefore what difference can it make whether it is furnished by coal or coke? If coke makes a fierce fire it generates steam quickly for a few minutes, then as the steam pressure rises the damper regulator checks the draft and deadens the fire so that no more heat is produced than if coal was used.

When a stack corrodes it is very convenient to say that coke caused it, if it has been used in that place, but stacks corrode and collapse where coal is used exclusively, for some of the gases produced from soft coal are as destructive as any that can be secured from coke, out of which nearly all of the gas has been extracted.

When a damper regulator of the lever type is to be installed the full stroke or travel of the lever should be utilized to open and close the damper, because less force is required to move it in this way than if it is so attached that a short movement of the regulator operates the damper. If but little force is required here a slight variation in the steam pressure will have the desired effect, therefore a steady pressure will be maintained. This refers more particularly to regulators that are operated directly by steam pressure.

There seems to be quite a difference of opinion among engineers concerning the throw of an eccentric. Some claim that it is equal to the travel of the valve, where the connection is direct, while others call it one-half of this travel. It appears logical to say that the throw is the distance that the eccentric throws the valve while the crank shaft makes one revolution, therefore if this view of the case is adopted as correct, "throw" and "stroke" mean the same.

The effect of absolute pressure, or perhaps it is more proper to say the difference between absolute and gauge pressure, is a mystery to some engineers; for although they understand there is a difference, yet the effect of it is not always understood. An illustration of this is found in the following incident:

An enthusiastic engineer claimed that he had discovered a way for pumping water into a boiler with a pump having steam and water pistons of the same diameter, for he intended to secure 100 pounds pressure on the steam piston, and then open a valve in the steam cylinder head which would give $100 + 15 = 115$ pounds on the steam piston and would drive it against the 100 pounds pressure on the water piston. He did not understand that atmospheric pressure would affect the water piston just as it did the steam piston, for in reality he had 115 pounds total pressure on both pistons, whether he admitted air to either one or not.

The manufacturer of a large lot of gate valves was willing to have them tested in the following way: Water pressure was to be raised to a stated point, by a boiler feed pump, the discharge pipe from which was 8 feet long. A valve was screwed on the end of this pipe and left open while water was pumped through it to expel the air, after which it was closed and full pressure put upon it. The inspector in charge applied his finger to the outside of the gate and finding it wet condemned the valve. The manufacturer explained the presence of a few drops of water there, but it did not change the decision of the inspector. When the next valve was put on no water was pumped through it, as it was closed at once, thus trapping air between pump and valve. As the pump was started this air was compressed, yet it must have prevented water from reaching the valve, and, as the inspector found it dry, he pronounced it satisfactory, and all of them (except the first) were tested in the same way. If a valve leaked slightly the compressed air would all disappear in a few minutes, and allow water to reach the valve, but the inspector did not wait for that. Of course the manufacturer offered no serious objection to this as his valves were accepted, but it was not a very rigid test.

The standard size for blow-off pipes of steam boilers is 2 inches, which is right provided the pipe is not reduced after the valve is put on. Recently I saw one that was reduced to ¾ inch in this way, and even then when the engineer wanted to use it he was obliged to connect several pieces of pipe in order to reach the sewer. This is a poor plan because a blow-off valve should be ready for instant use at all times. When used it should be opened wide in order to get a rapid circulation of water while it is open, so as to carry sediment out with it. Some of our pipe fitters regard the blow-off pipe simply as a means for emptying the boiler when it is to be inspected, and do not recognize the fact that it should be used every day.

In some plants that are used for electric lighting and street railway work, the time allowed for cleaning boilers is very short, and they are abused accordingly, for cooling a boiler rapidly and firing it up again in the shortest time possible results in unequal contraction and expansion which strains the sheets, tubes and joints much more than the steam pressure used.

When haste is necessary, the steam pressure should be disposed of, then a portion of the water run out and the boiler filled again with cold water. Repeating this three or four times is much better than to run all of the water out and fill it with cold water at once.

Care should be taken to know that all of the water is out and there is no steam in the shell before the manhole cover is removed, as neglect of this precaution has resulted in serious accidents. I have not found anything superior to a good flat, elastic gasket made in one piece without joint for packing these manhole covers.

"When is an automatic engine overloaded?" is a question on which there is a difference of opinion among engineers, for while one claims that when the terminal pressure is about 5 pounds above the atmosphere the engine has an economical load, another says that it is overloaded. If we start with a light load and a short cut-off, the terminal pressure is below the atmosphere, and the steam used per horse power is excessive. As we increase the load the total consumption of coal may be increased, but the weight per horse power is decreased. This continues for a time as the load is increased, but after a certain point is reached (which point will vary slightly in different cases) both the total consumption of steam and the amount disposed of per horse power per hour, is increased. The turning point between these two results is called the economical load, and it is customary to designate it by stating the terminal pressure.

If we did not have to contend with the effects of cylinder condensation the problem would be much more simple, for in a non condensing engine the economical load would be denoted by a terminal pressure equal to the difference between absolute and gauge pressure, whatever that may be, and for a condensing engine it would be equal to the absolute pressure existing in the condenser as determined by the reading of the vacuum gauge in connection with the atmospheric pressure existing in that place. The trouble with this practice is that these low terminal pressures result in excessive cylinder condensation, which overbalances the economy that would otherwise be secured by taking due advantage of the expansive qualities of steam. When some device or process is invented whereby this waste is reduced or entirely eliminated, a great improvement over our present practice will result.

Advocates of the high speed engine when it was first made claimed that where steam is admitted to and exhausted from a cylinder, say 600 or 800 times per minute, the condensation would be much less than for 300 times, and this is true; but the use of such high speeds greatly increased the bad effects of clearance and introduces or enlarges other objections, so that at the present time a medium speed is generally accepted as the best, so far as all around results are concerned.

Taking all of the foregoing into consideration it shows that for a non-condensing engine running at a high speed the most economical terminal pressure is but little above the atmosphere, while for a slow speed it will likely be 6 or 8 pounds higher. For a high speed condensing engine it will probably be found about midway between the absolute pressure in the exhaust chest and the atmospheric pressure. For a slow speed condensing engine it is about equal to the atmospheric pressure, which varies in different localities. In cases of this kind it is impractical to state figures arbitrarily, as only approximations are reasonable.

The maxim which teaches us to "Let well enough alone" is all right, and there can be no possible objection to an application of it to the practice of steam engineering. The only chance for an argument in the matter is concerning what constitutes "well enough."

An engine should never be termed "well enough" until an indicator has been applied and the actual internal conditions determined. One important point is the amount of compression secured. Carefully conducted experiments seem to show that it requires as much power to compress steam in a cylinder as can be secured from it by expansion as the piston advances. If this were true in all cases no compression above the atmosphere would be advisable, but few engines are run under this condition.

In our best practice the difference between boiler and initial pressure is only 2 or 3 pounds, but this is possible by securing a reasonable amount of compression, so that when the steam valve opens the clearance is already filled with steam at a few pounds less than steam chest pressure.

On some accounts the rule which tells us to give just enough compression to insure a quiet running engine and no more, is correct, but it cannot always be applied with profit, because enough compression to prevent pounding does not always result in minimum wear on crank and wrist pin boxes. One of the most quiet running engines that I ever saw had no compression above the atmosphere, but when this was increased to about 5 pounds less than initial pressure it made a great saving at the coal pile. The same lack of compression in another case made it almost impossible to run the engine for two consecutive hours. When the compression was adjusted properly a very great improvement resulted. I have succeeded in running a rather heavily loaded engine for 18 months without taking up the crank pin boxes, and it was not necessary to adjust them then, but this could not have been done without the right amount of compression.

It is probably safe to say that in no case should the compression be less than one-half of initial pressure (both by the gauge), and in some cases they should be equal.

SOME PAPERS PRESENTED AT THE GLASGOW MEETING OF THE INTERNATIONAL ENGINEERING CONGRESS.

[From our London Correspondent.]

Mr. Gisbert Kapp contributed a paper on "The Rating and Testing of Electrical Machinery," of which the following is a summary:

"With the growing application of electricity the commerce with electrical apparatus forms an important part of the general commerce of every civilized country. Such commerce should be put upon a safe basis by clearly defining the properties of the articles bought and sold. Electrical plant also enters into international commerce, and the question of how it shall be rated and tested appears to be a fit subject for an International Engineering Congress. The rating of electrical machinery must always be influenced by the condition of its use. Thus a tramway motor, rated by the builder at so many horse power will develop that power when in service only occasionally. The time during which this maximum power is required is short if compared with the total running time. Under these conditions the motor will not overheat. If, however, the same motor were used for driving a workshop, and had to give out the rated power continuously, it would break down from overheating. The same type of motor must, therefore, be rated differently in the two cases. The question of efficiency is frequently a source of trouble between buyer and seller, especially in direct coupled generators. The combined efficiency can easily be measured but not the efficiency of each part separately. According to the method employed, the separate efficiencies found may vary greatly; hence, to protect buyer and seller alike, it is desirable that there should be recognized methods for testing efficiency. These methods should be simple and inexpensive, and cause little disturbance to the regular working of the plant. The German Association of Electrical Engineers last year appointed a committee to investigate the question of rating and testing electrical apparatus, and has this year at the annual meeting provisionally adopted the report presented by the committee. The final adoption has been postponed until the value of the association "standards for rating and testing electrical machinery" has been found out by practical use. (These standards are given in an appendix to Mr. Kapp's paper.) By issuing them the association does not desire to interfere in any way between buyer and seller if the two parties agree in detail upon the properties which the articles bought and sold shall have. The standards are only intended to apply to that extent which is not covered by special conditions of the contract. The standards refer to electric generators, motors, connectors and transformers, but not to switches, fans and other subsidiary apparatus. As regards the rating, three working conditions are to be distinguished, namely, intermittent use, short time use, and continuous use. The working conditions must be stated on the name plate. The temperature rise is prescribed, and also the extent to which apparatus must be capable of being overloaded. A definite insulation resistance is not required, but a test for dielectric strength by application of high pressure. For testing efficiency eight methods are given, and the maker of the appartus is at liberty to select any of these as the method under which the efficiency he guarantees shall be tested. The method selected must be stated in the tender.

Mr. Robert Robertson, B. Sc., read a paper before the Naval Architecture and Marine Engineering Section on "Notes for Discussion on Electrical Power Supply in Shipbuilding Yards and Marine Engine Works." He discussed the advantages of electric power for engine works purposes: (1) Saving in cost of power; (2) flexibility of the system; (3) increased output. For shipyards all these advantages are greatly enhanced. The general principles of equipments were referred to, and single motors versus group driving was discussed. In conclusion those starting new engine works and shipyards were informed that their best policy was to adopt electrical power. In most cases it would pay to effect the change in existing works.

In "Design of Continuous Current Dynamos," Mr. H. A. Mavor considered as a whole the region occupied by the armature conductors in the magnetic field. He said that as present methods of designing dynamos and recording results do not readily lend themselves to comparison of machines of different outputs, it would be advantageous if a suitable unit of comparison could be devised. It was suggested in introducing the subject that a consideration of the continuous current dynamo, leaving out of account all the non-essential elements of design and construction, and concentrating attention upon the vital portion of the machine, which alone is concerned in the direct generation of energy, would lead to a suitable basis of comparison.

Mr. J. R. Dick dealt with "The Subject of Electricity Supply Meters of the Electrolytic Type." He said that in the evolution of the best supply meter, the type that survives will be the one that combines cheapness with the greatest permanent accuracy. Electrolytic meters are regarded by many as providing a solution of the problem on account of their inherent simplicity. The unshunted types of meters were discussed in a paper by Mr. A. H. Gibbings in 1898, so Mr. Dick devoted his attention to those which are shunted, and gave special consideration to those which depend on the measurement of the quantity of mercury deposited from a solution of mercurous salt. Reference was made to the water decomposing meter as an instance of the extreme simplicity of the former type. The author briefly recapitulated the chief features of the electrolytic meter thus: "It is cheap in first cost it has a very long range, and causes a very small drop in pressure. It forms a most convenient combination with a demand indicator. It will intergrate any current, however small, with perfect accuracy. It requires absolutely no attention, and its cost of maintenance is nil. The sense of security that such a meter should give to a central station engineer on the single point that every unit supplied to a customer is recorded, ought to and is removing the lingering objections which have hitherto attached to electrolytic meters as a class."

"The Relative Advantages of Three, Two, and Single-phase Systems for Feeding Low-Tension Networks," was the subject of a paper by Mr. Michael B. Field.

The Platinum Danger.

We referred a short while ago in these columns to a proposed German law prohibiting the use of platinum where it can be replaced without serious inconvenience by some other metal, and to limit its consumption to cases where its employment is essential. Discussing the situation in a short article in "Feilden's Magazine," the writer warns us against an impending platinum famine. The debate on the bill in the German Reichstag, he says, struck a note of warning regarding an imminent danger, the full importance of which appears not to be fully realized even among those who ought to be most concerned, but the restriction of the use of platinum in one country alone is hardly a practical measure for averting the dreaded consequence of a platinum famine. The problem, he suggests, is one of those that are eminently fitted for an international agreement, and should be carefully investigated by a commission composed of experts from all civilized countries.

On the many uses to which platinum is put, the writer points out the important part it plays in modern industries, although its extensive employment is only of recent origin. Thus, in the great chemical manufacturing processes there are operations in which it is practically indispensable, as, for instance, that of purifying acid, for which platinum retorts are used—each of which frequently represents a value of £2,000 or more—or various operations on which the accuracy of chemical analysis depends. Even more important is the use of platinum in electrical engineering processes, and in the manufacture of electrical apparatus. Also, as is well known, this metal has a very important function in incandescent lamps. It is, in fact, the only metal known around which glass can be fused. If it be added that it withstands abnormally high temperatures, and that no acids, excepting aqua regia, will attack it, it is easily comprehended that, unless a substitute combining these qualities be discovered, the exhaustion of its supply would have a serious effect upon more than one industry. We quite agree with the writer as to the great importance of taking steps to limit the use of platinum as far as possible, and think his suggestion that the matter should be carefully investigated by an international commission is worthy of earnest consideration.—"Electrical Engineer," London.

The Power of Niagara.

(From the "World's Work.")

If all the able-bodied men in Greater New York were working together turning a crank they would not equal the power to be developed in the two stations of the Niagara Falls Power Company; and they could work only eight hours a day, while the great current there flows forever.

The Louisiana Purchase Exposition.

The letting of contracts aggregating about $11,000,000 for construction work on the buildings and grounds of the Louisiana Purchase Exposition will begin about December 1. It is planned to apply about $7,000,000 of this amount on the buildings and about $4,000,000 on the grounds. The letting will begin with the contracts for four big exhibit buildings which, with their surroundings, will, it is estimated, cost about $4,000,000. The main buildings will be larger than those of any previous exposition in Europe or America. Some will exceed similar buildings at former expositions by over 25 per cent.

This is the stage which work on the big Louisiana Purchase Exposition has reached.

The site has been selected to embrace the unfinished half of one of the largest public parks on earth—Forest Park. The part of the park to be used contains 668 acres and about 300 acres of surrounding property will be added to bring the entire area of the site up to about 1,000 acres.

The ground plans of the exposition have been drawn up by a commission of architects in which every section of the country was represented. Isaac S. Taylor, of St. Louis, was its chairman. The other St. Louis members are Eames & Young, Barnett, Haynes & Barnett, Widmann, Walsh & Boisselier and Theodore C. Link. New York was represented by Carrere & Hastings, and by Cass Gilbert of New York and St. Paul; Boston by C. Howard Walker; Kansas City by Van Brunt & Howe; Omaha by Thomas R. Kimball. The commission of architects had the advantage of the advice of a board composed of a sculptor, Mr. F. W. Ruckstuhl, of New York; a landscape engineer, Mr. Julius Pitzmann, of St. Louis, and a landscape architect, Mr. George E. Kessler, of Kansas City, who laid out the boulevard and park system of Kansas City.

The details of the general arrangement have been worked out by Mr. E. L. Masqueray, of New York, as chief designer. Mr. Masqueray received his early training in architecture at the Ecole des Beaux Arts, Paris, and received a gold medal at the first salon at which he exhibited.

The site has been surveyed and the lines of buildings and avenues staked off.

The designs for the separate buildings, assigned to the individual members of the commission of architects, will be submitted in scale drawings by the middle of October and the working drawings of the main buildings to be let first will be ready by November 1. The lettings will be advertised for about three weeks in the leading technical journals throughout the world. There will be no geographical restriction on bidders. The main stipulation will be that the buildings be ready for occupancy at a date sufficiently far ahead of April 30, 1903, the date fixed for the opening of the exposition, to allow exhibitors time to prepare their displays for the opening. To secure the completion of the buildings by this time, a sufficient bond will be required of the successful bidders. Materials will be employed in the construction work and conditions will be so adjusted that contractors may fulfill their contracts.

Sprague Multiple Unit System.

One of the most important inventions in recent years is the Multiple Unit System of control for electric train operation. It was invented and named by Mr. Frank J. Sprague, the well known inventor and pioneer in electric railroading, and is covered by U.S. Fundamental Patent No. 660,065, which is owned by the Sprague Electric Company.

It is a method of train operation and control by which any number of motor cars and any number of cars without motors can be combined into trains at will, and operated from any one of as many points as desired through master switches and a controlling line common to all the cars.

A great variety of combinations can be made to fit any condition of service.

The essential features of multiple unit equipments are the master switches, the train line cables, coupler and jumper, a reverser for determining the direction of movements and a speed controller, all of which have been reduced to a condition of reliable and standardized construction. The operator by a movement of the hands at any one of the operator's switches can effect definite movements of the train as to acceleration, speed and direction. The system covers the entire range of service from a single car to a train of any length equipped with as much or as little power as may be required. It saves time, labor and material in operation and economizes in cost of maintenance of roadways and structures. The Sprague Multiple Unit Controlling Apparatus has been successfully installed on the following roads: Chicago South Side Elevated, Brooklyn Elevated, Versailles Division of the Western Railway of France and the Boston Elevated, the latter being the most difficult service in the world. The Sprague apparatus marks a new era in electric railroading.

The New North German Lloyd Liner Kronprinz Wilhelm.

The new North German Lloyd steamship Kronprinz Wilhelm, which arrived in this port on its maiden voyage Wednesday, September 25, embodies all the latest electrical inventions to be found in an ocean greyhound.

The Kronprinz Wilhelm was built by the Vulcan Shipbuilding Company of Stettin, Germany. Her dimensions are 663 feet length, 66 feet beam and 43 feet depth; her gross tonnage is 15,000 and her displacement 21,300 tons.

The Kronprinz Wilhelm is of the same type as the express steamship Kaiser Wilhelm der Grosse, of the same line, but is fifteen feet longer. The new steamship has been built of the best German steel as a four deck vessel, with numerous extras, and has received the highest class of the Germanic Lloyd Register.

Her accommodations for first-class cabin passengers are placed amidships, on the main, upper and promenade decks. She is provided with every possible comfort for the traveling public. Four cabins de luxe, composed of sitting room, bedroom and bathroom, and eight apartments consisting of bedroom and bathroom have been furnished for the accommodation of those who wish to travel luxuriously.

The motive power consists of two six cylinder quadruple expansion engines, indicating 33,000 horse power. The steam is furnished by sixteen boilers, of which twelve are double boilers. The coal consumption is about 500 tons per day. The bunkers hold 4,450 tons of coal. The crew consists of about 500 persons. The Kronprinz Wilhelm contains a number of remarkable new technical improvements. An extensively ramified telephone service connects the captain from his room on the bridge with the chiefs of the various departments of the steamer. The chief steward is provided with an office similar to the office of a modern hotel, where the public can secure information on matters pertaining to their tickets, baggage, rooms, etc.

The apartments de luxe are connected with the chief steward's office by telephone.

The Kronprinz Wilhelm, as are all other new vessels of the North German Lloyd, is provided with an apparatus for wireless telegraphy.

Electric Propulsion for Small Boats.

Editor Electricity.

Sir: A gentleman connected with the Edison Manufacturing Company handed me your issue of the 18th inst. with a paragraph relative to a new electric propeller for small boats.

I beg to say that some time since Mr. John S. Lyle, who, in connection with his wife, built and equipped "Happyland" for the "Tribune" fresh air children, asked me if his 18 foot Racine boat could be operated with electric propulsion. I told him that I would think the matter out and the result was reached last Tuesday when my son took out nine children, four to fourteen years of age, at a time in the above boat, running the same for a period of four hours, and having run the boat previously for three and one-half hours.

The equipment consists of 10 cells of our dry battery, each 2 x 4 x 8 inches, with a total weight of 45 pounds, and a motor designed for operating sewing machines weighing 5 pounds. The propeller has three blades 9 inches in diameter.

Before starting the run on Tuesday the 10 dry cells tested 15 volts, 22 amperes. At the conclusion of the run they tested 12 volts, 10 amperes, and within an hour recuperated to their original test.

The above was purely experimental. The boat was operated on slack water at a speed of about 3½ miles an hour with 9 children aboard. The connection between motor and propeller shaft was by means of a round leather belt, 6 inches of which was immersed in the water, ultimately causing a very considerable slip and loss of power, yet 3½ miles an hour was the lowest speed attained.

I am having constructed a flexible shaft for direct connection, also a 2 blade propeller. With this equipment I will easily double above results, and with the increasing weight of motor field and enlarging armature, making a total of 12 pounds for motor, with 90 pounds of our battery, I shall not fear tidewater.

Thinking that the above might interest your readers I desire to say that the equipment will be open for your inspection just as soon as I receive the flexible shaft and fit same to boat.

Yours very truly,

Wm. Newcomb,
Manager P. & W. Electrical Co.

New York, Sept. 26, 1901.

Decision in an Infringement Suit.

Judge William K. Townsend of the United States Circuit Court has handed down an important decision in the infringement suit of the General Electric Company of Schenectady, N. Y., against the Winsted Gas Company of Connecticut. The General Electric Company maintains that a machine used by the defendants is exactly similar to one made by the General Electric Company on a patent issued to Rudolph Eickemeyer. Judge Townsend's decision is that the two machines are entirely different and that no infringement exists or can exist.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended September 25:

Amsterdam, 1 case, $20; Antwerp, 20 cases, $1,665; Argentine Republic, 82 cases, $4,971; Australia, 264 packages, $18,647: Azores, 1 case, $46; Bali, 1 case, $30; Berlin, 4 packages, $50; Brazil, 16 packages, $715; British East Indies, 7 packages, $460; Bristol, 9 cases, $500; British Possessions in Africa, 3 cases, $58; Central America, 32 packages, $288; Chili, 12 packages, $207; Cuba, 24 cases, $419; Ecuador, 1 package, $54; Glasgow, 1 package, $47; Hamburg, 45 cases, $1,785; Havre, 16 cases, $467: Japan, 14 cases, $995; 20 packages, $6,600; Leeds, 1 case, $101; Leicester, 1 package, $70; Lisbon, 20 packages, $5,560; 5 cases, $146; Liverpool, 85 cases, $4,671; London, 300 packages, $10,303; Manchester, 1 case, $30; Mexico, 150 cases, $9,198; Philippines, 6 packages, $240; Southampton, 7 packages, $346; Uruguay, 4 cases, $275; Vienna, 1 case, $75.

A Beautiful Steel Engraving for Two Cents.

Upon application at any postoffice in the United States, a beautiful steel engraving, in miniature, of the New York Central's "Empire State Express," the most famous train in the world, will be furnished for two cents.

This engraving affixed to a letter will insure its transportation to any point in the United States, Canada, Porto Rico, Alaska, the Hawaiian Islands, Guam or the Philippine Archipelago.

PERSONAL MENTION.

Judge J. M. Wilson, who died suddenly on September 24 at Washington, D. C., was president of the Chesapeake & Potomac Telephone Company.

Mr. J. P. Coppinger, superintendent of the plant of the Edison Electric Illuminating Company of Lebanon, Pa., has recently been in New York City purchasing new machinery for the works.

Prof. F. C. Van Dyck, who holds the chair of electricity and mechanics at Rutgers College, has been made dean of the faculty.

Mr. C. L Edgar, president of the Boston Edison Company, has returned home from Europe.

INCORPORATIONS.

The Kutztown Electric Light, Heat & Power Company, Kutztown, Pa. Capital stock, $1,000.

The Broome County Electric Company of Binghamton, N. Y. Capital stock, $100,000. Directors: F. J. Sands and D. R. Buckley, Unadilla, and S. D. Kane, Binghamton.

The American Telegraphing Company, Trenton, N. J. Capital stock, $10,000. Incorporators: Frank A. Briggs, Trenton; E. W. Creecy and Stilson Hutchins, Washington, D. C.; Charles A. Lieb and E. H Serrin, New York City.

The Wateree River Electrical Power Company, Trenton, N. J. Capital stock, $260,000. Incorporators: Frank M. Zenip, Eugene C. Zenip and S. Logan Lang, all of Camden, S. C.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED SEPT. 24, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

683,026. Trolley-Catcher. Charles I. Earll, New York City. Filed Feb. 26, 1901.

683,230. Electric Circuit Closer for Railway-Tracks. Fritz Sock, Magdeburg, Germany. Filed Feb. 25, 1901.

683,250. Electric Rail-Bond. Samuel P. Cowardin, Richmond, Va. Filed Feb. 19, 1901.

683,279. Control System for Electric Cars. Carl Hochenegg, Vienna, Austria-Hungary, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Jan. 22, 1900. Renewed Aug. 2, 1901.

683,283. Electromagnetic Traction Increasing Apparatus. Albert A. Honey, Tacoma, Wash. Filed Nov. 20, 1900.

683,284. Electromagnetic Brake. Albert A. Honey, Tacoma, Wash. Filed Nov. 22, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

683,046. Incandescent-Lamp Protector. John M. Howley, Bayonne, N. J. Filed June 20, 1901.

683,062. Inclosing Structure for Electric-Arc Lamps. William H. Northall, Elwood, Ind. Filed Nov. 12, 1900.

683,085. Manufacture of Filaments for Incandescing Electric Lamps. William L. Voelker, London, Eng., assignor to Theron Clark Crawford, New York City. Filed July 30, 1900.

683,086. Manufacture of Filaments for Incandescing Electric Lamps. William L. Voelker, London, Eng., assignor to Theron Clark Crawford, New York City. Original application filed July 30, 1900. Divided and this application filed Nov. 19, 1900.

ELECTRICAL MACHINERY AND APPARATUS.

683,045. Electric Coupling for Conductors. Charles Holzmann, Budapest, Austria, Hungary. Filed March 5, 1900.

683,052. Armature-Core for Electrical Machines. Gerhard Kopplemann, Schuttorf, Germany. Filed June 15, 1901.

683,066. Electric Tube-Welding Machine. Otto Parpart, Cleveland, O., assignor to the Standard Welding Company, same place. Filed Sept. 1, 1900.

683,172. Electrical Block-Signal System. Samuel L. Foster, San Francisco, Cal., assignor to the Market Street Railway Company, same place. Filed Oct. 16, 1900.

683,186. Thermostatic Switch. William F. Singer, New York City, assignor to the Singer Automatic Ice Machine Company, Jersey City, N. J. Filed Jan. 14, 1901.

683,218. Electric Switch. King W. Mansfield and William R. Thompson, South Norwalk, Conn. Filed July 6, 1900.

683,235. Motor Generator. Rene Thury, Geneva, Switzerland. Filed Jan. 11, 1900.

683,253. Electric Generator or Motor. Philip J. Darlington, Montreal, Canada. Filed Aug. 15, 1898.

683,334 Electromagnetic Brake. Arnold A. Robertson, Titusville, Pa. Filed April 18, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

683,266. Telephone-Receiver. Samuel J. Friedman, McKeesport, Pa. Filed Feb. 23, 1901.

MISCELLANEOUS.

683,051. Paper-Carriage Feed Device for Printing-Telegraph Mechanism. Oscar L. Kleber, Pittsburg, Pa. Filed Sept. 10, 1900.

683,060. Insulating Construction. Tobias New, Brooklyn, N. Y. Filed Feb. 11, 1901.

683,098. Electric Cloth or Fabric. Louis Baecker, Detroit, Mich., assignor of one-half to Elias Eberle, same place. Filed June 24, 1901.

683,130. Toy Graphophone. Thomas H. Macdonald, Bridgeport, Conn., assignor to the American Graphophone Company, Washington, D. C. Filed Feb. 21, 1899.

683,133. Interchangeable Electric Display Apparatus. George L. Mason, New York City, assignor to the Mason Monogram Company of New York. Filed Sept. 10, 1898.

683,208. Composite Insulating Material. George Kelly, Mineralpoint, Wis. Filed June 25, 1901.

683,214. Signal System. King W. Mansfield and William R. Thompson, South Norwalk, Conn. Filed July 21, 1900.

683,216. Therapeutic Battery. Joseph A. Minturn, Indianapolis, Ind., assignor to the Oxypolar Company, same place. Filed June 10, 1901.

683,257. Electric Programme-Clock. Benjamin Dubinski, San Antonio, Tex. Filed April 1, 1901.

683,263. Electrolytic Production of Cathode-Plates. Elmer G. Elliott and Valentine Kishner, Perth Amboy, N. J. Filed Dec. 29, 1900.

683,341. Electric Alarm-Mat. Albert D. Shaw, New York City. Filed June 25, 1901.

683,397. Signaling Mechanism. Reinhold Herman, Crafton, Pa. Filed Jan. 14, 1901.

683,400. Submarine Boat. John P. Holland, Newark, N. J., assignor to the Electric Boat Company of New Jersey. Filed April 26, 1900.

THE TELEPHONE WORLD.

Independents Combine to Fight the Bell.

The independent telephone company which is asking for a franchise in Rock Island, Ill., and will soon reach Moline, is part of a scheme to combine independent lines which now cover Northern Illinois like network outside of Chicago.

The combine has secured control of the Whiteside County Telephone Company with headquarters at Sterling, and is now waiting only for authority to enter Rock Island County and Moline.

For the cut rate of 5 cents it is reported it will soon be possible in all parts of Northern Illinois to talk over long-distance instruments and modern equipments between towns where the Central Union demands 25 cents or more. Once in, Moline can talk to Clinton.

The new competitive combine which is to give these blessings puts its capital at $10.000,000. It is buying up the independent telephone lines in all the Northern Illinois territory outside the boundaries of Chicago and Cook County.

The new company is to operate independent or "competing" switchboards at Aurora, Elgin, Geneva, Joliet, Sterling, Rock Island, Peoria, in Illinois, and Clinton and Oskaloosa in Iowa. Already the new concern has acquired control of independent lines heretofore in operation at all these points except Peoria. In the latter city a franchise was sought on behalf of the pool.

The town council of Canandaigua, N. Y., has granted a franchise for the construction of a telephone plant at that place to the Inter-Ocean Telephone & Telegraph Company, which operates long-distance lines through the southern portion of the State. An exchange will also be built at Waterloo. In a short time the line between Rochester and Syracuse, now building by the company, will be finished, and when all is done the northern and southern tiers of counties will be brought into intimate telephonic communication.

At the general election the citizens of Sioux City, Ia., will very likely have a chance to vote a telephone franchise to a new company, which is arranging to enter into competion with the Iowa Telephone Company. An attorney recently stated that he had drawn up resolutions, which will be presented to the city council at an early day, providing for a submission of the question to the people. A. B. Beall is interested in the movement, and the resolutions were prepared at his instance.

The annual meeting of the South Shore Telephone Company was held last week at the office of Libby & Heyward, Freeport, N. Y. Reports were submitted showing the company to be in a prosperous condition, having over 350 subscribers in the various villages. The election of directors resulted as follows: John J. Randall, Charles D. Smith, William D. Carter, George P. Bergen, Valentine G. Walters, William G. Miller and Henry P. Libby.

The Northland Telephone Company of Duluth, Minn., was recently incorporated with a capital stock of $25,000. It will be a long distance associate of the Zenith Telephone Company, the local independent line, and it proposes to give service to the iron range and the surrounding country, including a connection with the Consolidated Telephone & Telegraph Company, which will give independent connection with the twin cities. The incorporators are: C. C. Kritzer, V. Carlson, H. A. Allen, A. E. Webster and M. Mecalson.

The New York "Commercial" of September 25 says: "C. W. Morse holds an option on two-thirds of the capital stock of the Telephone, Telegraph & Cable Company of America. If Mr. Morse purchases the stock, it is said he will immediately arrange for the disbursement of $3,000,000 for the construction of a duplicate pole line between Boston and New York, and for the establishment of an exchange in Boston with 15,000 subscribers and one in New York with 10,000 subscribers.

On account of the recent advance in the rent of 'phones by the Albemarle Telephone Company there is much dissatisfaction among the citizens of Scottsville, Va., who are using its 'phones. There is a strong feeling in Scottsville towards getting up a new telephone exchange for that town and vicinity,

The Pass Creek Telephone Company, that has established a line for the use of the farmers in the vicinity of Bozeman, Mont., is beginning to put in 'phones at different farm houses and so far they have proved successful.

The Flandreau, S. D., telephone system is being enlarged and improved. The old switchboard, which had 50 keys, has been replaced by one with a capacity of 125.

The New York State Telephone Company filed articles of incorporation with the Secretary of State at Albany last week, and paid $1,250 as an incorporation fee. The amount of the capital stock of the new corporation is said to be $1.500,000, and it purposes, the articles of incorporation state, to maintain lines of electric telephone wholly within or partly beyond the limits of this State. A "general route" within the limits of the city of Buffalo is mentioned. The directors of the new company are William F. Mackey, of Buffalo; William D. Barnard, of St. Davids, Pa.; Henry Shafer, of Chicago; Richard G. Park, of Westchester, Pa.; C. M. Clement, of Sunbury, Pa.; Edward Davis, of Philadelphia, and Ward R. Bliss, of Chester, Pa.

The annual meeting of the Eastern Telephone Company was held at Rockland, Me., a short time ago. The old board of officers were re-elected as follows: Frederick S. Walls of Vinal Haven, president; Maynard S. Bird of Rockland, general manager; Hon. W. T. Cobb, F. S. Walls, W. S. White, Fred R. Spear and Maynard S. Bird, directors. The reports showed a very successful year for the company that is branching out in all directions in Maine and rapidly covering the most populous centers of the State with its wires. While no dividend was declared on the stock a goodly amount was added to the surplus. The Eastern Company is rapidly covering Oxford County; being now engaged in running a line from Turner Center to Lewiston and Auburn. The directors voted to construct a line from Auburn to Danville Junction and the company has made contracts to connect with eight other companies in Oxford and Cumberland Counties, which will give it 1,600 subscribers there this fall. They will connect with Lewiston from Rockland next year, and will thus reach the center of population of Maine.

James S. Warren, general manager of the Memphis, Tenn., Telephone Company, positively denies a persistently circulated report that his company and the Cumberland Company are upon the point of consolidation. Mr. Warren states that there have been no negotiations whatever between the two companies. The Memphis Company, he says, is entirely independent, and will continue so. Work on the Memphis Company's new building on 2d street has been delayed somewhat by the failure of structural iron to arrive on time. The building is to be rushed through to completion as rapidly as possible.

The National Conduit & Cable Company of New York has been awarded the contract for laying the conduits for the People's Telephone Company, who has been granted a franchise to operate a telephone exchange in Lynn, Mass. The contract calls for about 50,000 feet of conduit, which will be cement lined iron pipe, the same as used by all the largest users of conduits in this country. Work will be commenced by the first of this month and pushed rapidly forward.

B. F. Morfoot, of the Cohoes & Waterford, N. Y., Home Telephone Company, has lately been in Cohoes soliciting for subscribers for the company, which, he stated, would have everything in working order by spring. This system is comparatively cheaper, he claims, than the present system of telephones. The cost per year in residences is $20, and the business telephone system will be $40 per year.

Griffin, Ga., is to have a new telephone concern known as the Griffin Telephone Company and organized with the following officers: President, A. J. Burr; vice-president, J. D. Boyd; secretary and treasurer, J. E. Drake; superintendent, C. B. Thomas; attorney, W. E. H. Searcy, Jr. Attorney Searcy will make application for a charter right away, and the order for supplies, etc., will be rushed off shortly.

Within a short time Winnipeg, Can., and Minneapolis, Minn., will be in direct telephone communication. The increased business that is growing up between this country and Canada has aroused the telephone companies of both countries to the fact that direct communication is needed. The Bell Telephone Company of Canada is extending its lines and they will meet the American company at Neche.

At a meeting of the directors of the Home Telephone Company of Cortland, N. Y., Fred V. Bennett, of Homer, N. Y., was appointed manager of the local system, and began duties on October 1. Mr. Bennett takes the place of Willard F.S. Jones, who tendered his resignation as manager.

The Cumberland Telephone Company has about completed the work of putting in poles and wires for an exchange in Woodbury, Tenn., and suburbs.

There is a widespread desire for a telephone line from Worcester to South Worcester, N. Y.

L. E. Pike & Co., of New York, Boston, Chicago and elsewhere, with main offices in Springfield, Mass., promoters of Washington Copper & Milling Company, offer the public a new proposition—stock in the Federal Wireless Telegraph & Telephone Company. According to the quarter-page advertisements, which appeared in certain papers, the company controls territory with a population of more than half the United States. Having control of so much territory, which the general public had not deemed possible, a wireless telegraph company, it is suggested, ought to be a positive asset, especially if the telephone part of the company is also a wireless system. "A few years ago a certain stock could be bought for 50 cents a share, and the same stock is now held at $4,000 a share," is an instance of a phenomenal rise in values cited by Pike & Co., who assure the public that "wireless telegraphy has an even more promising outlook." The par value of the stock is $1 a share, but a "limited amount" can be had for 40 cents.

News received from Erie, Pa., states that at a recent meeting of the stockholders of the Mutual Telephone Company, a proposition to increase the bonded indebtedness of the company from $50,000 to $75,000 was voted upon and carried without dissent. The $25,000 realized on the bonds is for the purpose of canceling a floating debt of that amount, contracted by the recent extension of the company's lines, and the purchase of additional equipment. The statement of Manager John Z. Miller to the directors shows that the affairs of the company are in an excellent condition. The number of its subscribers is being increased continually. W. B. Trask is president of the Mutual Telephone Company, and George Burton is secretary and treasurer.

The Fall River, Mass., Automatic Telephone Company has commenced operating its exchange with a portion of its subscribers, and is adding to the number as fast as telephones can be put in and connected by the present gang. New applications for the automatic service are coming in freely on account of the satisfaction given. The Strowger Automatic Telephone System is used, the same system as that installed in New Bedford, Mass., some months ago, but with important improvements.

A branch of the People's Telephone Company's line has recently been extended to Allen's Hill, N. Y. The branch to Richmond Mills has been changed so as to connect without intermediate switching with Honeoye N. Y. Some 40 'phones are now in touch with the line between Vincent and Hemlock.

The New York & New Jersey Telephone Company has purchased the Barnes mansion at Clinton and Atlantic avenues, Brooklyn.

An item from Swedesboro, N. J., states that Woolwich township has given the Interstate Telephone Company permission to run its lines through the township.

The Rensselaer, N. Y., Telegraph & Telephone Company has filed a certificate with the Secretary of State, setting forth that its capital stock has been increased from $150,000 to $300,000.

Articles of amendment have been filed by the Lewisburg, O., Telephone Company, enlarging its purpose.

The Southern Bell Telephone Company is establishing a line to Adairsville, Ga.

There is talk of a telephone line from Crewsville to Zolfo, Fla. The length of the line will be 15 miles.

TELEPHONE INCORPORATIONS.

The Albion Telephone Company, Albion, Pa. Capital stock, $5,500.

The Cridersville Telephone Company, Cridersville, O. Capital stock, $5,000.

The Viola Telephone Company, Viola, Minn. Capital stock, $10,000.

The Fairview Telephone Company, Alexandria, Minn. Capital stock, $2,000. Incorporators: F. A. Gregory, N. Van Tassel and William Newman.

The Neoga Telephone & Telegraph Company, Neoga, Ill. Capital stock, $2,500. Incorporators: John A, Baughman, Daisy Baughman and Mamie A. Sheehan.

The Lenox & Clearfield Telephone Company, Des Moines, Ia. Capital stock, $15,000. Incorporators: O. D. Tyler, J. P. Scroggs, D. N. Smith, Henry Baum and Shirley Baum.

The Waverly Telephone System of Iowa, Des Moines, Ia. Capital stock, $30,000. Directors: G. E. I ickley, G. B. Bennett, A. A. Broadie, Burton E. Sweet and F. L. Smalley.

GENERAL ELECTRICAL NEWS.

Lighting.

Batesburg, S. C.—This town has obtained a new charter to enable it to arrange for electric lights, which it could not do under the old charter. U. C. Gunter, Jr., prepared the papers for the new charter.

Bennettsville, S. C.—This place is ready to receive bids on a lighting plant of 40 arc and 1,000 incandescent lamps. Milton McLaurin is treasurer.

Boonville, N. Y.—H. B. Sweet, electrical engineer, has submitted to the village board a detailed estimate of the cost of an electrical equipment for a lighting plant for the village. The plan contemplates the installation of two two-phase 50 kw. alternating generators which will be capable of operating service for either arc or incandescent lighting, or motors for power.

Caldwell, O.—The vote taken here to issue bonds for $5,500 to enlarge the electric light plant resulted 135 for and 20 against.

Corry, Pa.—The Corry Electric Light & Power Company was lately established here with $10,000 capital.

Eustis, Fla.—E. L. Ferran & Co. contemplate installing an electric light plant.

Fullerton, Neb.—Thomas Lee has been granted a fifty-year franchise by the city council for electric light and power purposes.

Georgetown, Tex.—The city council at its last meeting ordered an election to be held here October 5 to determine whether or not this city shall issue bonds to the amount of $8,000 for the purpose of building and purchasing for the city an electric light plant.

Harrisonburg, Va.—The recent election on the question of whether the town should install its own electric lights brought out a small vote and another election will be held.

Huntingdon, Tenn.—This city contemplates expending $2,000 for the installation of a new dynamo, and otherwise improving its electric light plant.

Jackson, Ga.—Northern parties have secured a franchise and will erect an electric light plant. Probably Mayor C.O. Beauchamp can give information in regard to same.

Lena, Ill.—This place is to be lighted by electricity.

Marshall, Mo.—Hiram and Richard Phillips of St. Louis are preparing plans and specifications for the proposed municipal electric light plant to cost from $60,000 to $70,000. A. R. James city clerk.

Mountain Lake Park, Md.—The Garrett Water & Light Company, recently incorporated, will install an electric light plant of 800 to 1,000 incandescent lamps and 20 to 25 arc lamps. L. A. Rudisill is secretary.

Parkersburg, W. Va.—This city has decided to construct an electric plant for lighting. The mayor can be addressed for further information in relation to same.

Pottsville, Pa.—The Schuylkill County Electric Company, capitalized at $10,000, has been formed here.

Winchester, Ill.—The electric light plant here was burned recently, entailing a loss of $5,000; insurance, $2,000.

Woodstown, N. J.—The citizens of this place are considering the question of an electric light plant at a cost not to exceed $7,000.

Street Railways.

Atlantic Highlands, N. J.—There is every prospect that the trolley will be installed here in the near future. The Matawan & Keyport Electric Railroad Company has already secured the right-of-way as far as Keansburg from Keyport, and the route will follow from there directly to the Highlands. Representatives of the company have been in conference with the officials of this place and a route through the town has been agreed upon.

Bloomsburg, Pa.—The Shickshinny borough at a recent council meeting granted the Shickshinny & Huntingdon Valley Electric Railroad the right of-way through the town. The road will connect Shickshinny, Harveyville and Huntingdon Mills.

Chatham, O.—The county commissioners have granted the Columbus & Granville Electric Road a franchise to construct an electric line from the north corporation line through this place and Utica to connect with a line to be built to Mt. Vernon. F. M. Black is secretary of the company.

Clinton, Ia.—The Illinois & Iowa Electric Railway Company, with a capital stock of $125,000, has filed articles of incorporation here. The company proposes to build a railway between this city and Davenport, a distance of 42 miles. The stockholders are Eastern capitalists.

Columbus Grove, O.—At the regular meeting of the village council a representative of the Toledo & Lima Traction Company will ask that a franchise through the city be granted his electric line.

Edwardsville, Ill.—Engineers have completed a profile of a proposed electric line between this city and Granite City, the route to be direct from the courthouse here to that place.

Galesburg, Ill.—P. B. Knox of Chicago is expected here to figure on estimates for the construction of the new electric line to Abingdon for the People's Traction Company.

Iron Mountain, Mich.—The common council has granted a franchise to the Menominee Range Street Railway Company, which will build an electric road from here to Vulcan.

Jackson, Ga.—A company has been organized to construct an electric street railway in this town and suburbs. The power will be secured from the Ocmulgee River. Northern capitalists, it is stated, are interested.

Jackson, Mich.—At the next city council meeting petitions will be presented signed by more than 3,900 citizens asking that a franchise be granted to Hawks & Angus to build and operate an electric railway system in this city.

Keene, N. H.—The Humphrey Machine Company has contracted with Daniel R. Cole to take out the two water wheels which he put in at his South Keene mill a few years ago, and substitute therefor a pair of IXL wheels. Mr. Cole then intends to put in an electrical machine to generate power for the Keene Electric Railway.

Lawrenceville, Ill.—A new electric railway is to be built from here to East St. Louis.

Los Angeles, Cal.—The owners of the Temple Street Cable Railway of this city have decided to adopt electricity for the motive power of the line, and a new electric plant will be installed at a cost of $60,000 to $75,000.

Mineola, N. Y.—It was reported last week that M. J. Mandelbaum, of the Pomeroy-Mandelbaum Syndicate of Cleveland, had concluded negotiations for the purchase of the Mineola, Hempstead & Freeport Traction Company's line now under construction.

Omro, Wis.—The proposed Omro-Oshkosh electric railroad will be built this fall.

Oneida, N. Y.—The trolley system for this place is rapidly becoming a certainty.

Pittsburg, Pa.—The Monongahela Traction Company, owning 25 miles of track in this city and up the Monongahela valley through Wilkinsburg, Braddock, Homestead, Duquesne and McKeesport; and the Pittsburg & Birmingham Traction Company, owning 28 miles of track, here have been sold to the Widener-Elkins Syndicate of Philadelphia, according to the best information obtainable here.

Radford, Va.—A contract has been let for the construction of an electric road to run from this place to Floyd Courthouse, a distance of about 25 miles. The power house will be located here.

Richmond, Va.—Within a few months the plant of the Virginia Electrical Railway & Development Company will be the largest and most perfect of its kind in the South. The contract to furnish power to the Richmond and Petersburg trolley line for a great part of its distance has been made.

Savannah, Ga.—The city authorities have decided to sell at auction a franchise to construct an electric railroad along certain streets.

Shreveport, La.—The city council has given a franchise to a company which proposes to build an electric railway in the city and suburbs.

Manufacturing.

Chicago.—The McMaster-Davis Supply Company of this city, capitalized at $50,000, has been incorporated to manufacture steam and electrical supplies. T. J. McMaster, F. C. Davis and George Davis hold an interest in the concern.

New York City.—The Graham-Fox Motor Company, recently formed, will manufacture motors and automobiles on a capital of $500,000. Frank A. Fox and David F. Graham, Stamford, Conn.: James J. Thornley, Jr., Brooklyn; C. G. Weaver, New York City, and W. D. Blake, Richmond Hill, L. I., are the directors of the company.

Company Matters.

Cleveland, O.—The capital of the Lake Shore Electric Company of this city has been increased from $10,000 to $6,000,000, to absorb four lines belonging to the Everett-Moore Syndicate.

Lancaster, Pa.—The Columbia Electric Light & Power Company has sold out to the Lancaster County Railway Light & Power Company for $65,000.

New York City.—The United States Non-inflammable Wood Company has been organized with a capital of $2,250,000. This step is virtually a reorganization of the Electric Fireproofing Company.

Power and Transmission.

New Westminster, B. C.—The British Columbia Electric Railway Company and the Vancouver Power Company will shortly expend $600,000 in developing the water power of the Coquitlam, for transmission to Vancouver and New Westminster. It is expected that 5,000 hp. will be generated.

Pocatello, Ida.—The American Falls Power, Light & Water Power Company has filed its articles of incorporation at this place. The company is capitalized at $300,000. The directors are J. H. Brady, D. W. Standrod, A. F. Caldwell, all of Pocatello, and R. Rounds and A. V. Scott of Idaho Falls. The purposes for which the company is organized are twofold—the harnessing of the immense power of the Snake River at American Falls, to generate and transmit electrical energy, primarily for Pocatello, and the constructing of canals for irrigating the lands around American Falls.

Mines.

Houghton, Mich.—Electricians are preparing to install a system of wires in the Quincy Mine near this place for the purpose of operating electric locomotives. The new system will largely displace the use of manual labor, and will also provide better lighting facilities. Two locomotives, each capable of pulling 16 tons of rock, will be operated at first, but it is believed that their introduction will lead to the general use of electricity in the mines of the Michigan district.

Automobiles.

Albion, Mich.—It is stated that an automobile factory is one of the possibilities in connection with the Gale Manufacturing Company.

Chicago.—The Bowman Printing Press Company has changed its name to the Flash Boiler Automobile & Specialty Company. The capital stock decreased from $1,000,000 to $500,000, and the object changed to do a general manufacturing business. The number of directors increased from three to five.

St. Louis, Mo.—The St. Louis Automobile Manufacturing, Storage & Repair Company filed articles of incorporation here lately. The capital stock is $2,000, paid. John J. Meilke, George W. Bonney, Edward M. Doyle and W. J. H. Perkins are the shareholders.

Wilkes-Barre, Pa.—The Union Motor Transportation Company is again considering the establishment of a belt line to include certain streets in this city, and also the advisability of constructing a private electric plant for the purpose of charging the vehicles.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, September 30, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	33	36
Broadway and Seventh Avenue	100	240	245
Central Crosstown	100	266	280
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	180	185
Dry Dock, East Broadway and Battery	100	120	128
Eighth Avenue	100	390	405
Metropolitan Street Railway	100	163	163¼
Ninth Avenue	100	196	200
Second Avenue	100	215	218
Sixth Avenue	100	175	215
Third Avenue	100	120	120¼
Twenty-Third Street	100	390	410
OTHER CITIES.			
Albany United Traction	100	106	107½
Brooklyn City Railway	100	242	244
Brooklyn Rapid Transit	100	65	65¼
Baltimore United Railways, com	50	16½	16¾
do. do. do. pref	50	91	92
Buffalo Railway	100	110	111
Cleveland City Railway	100	120	121
Cleveland Electric Railway	100	87½	88⅝
Columbus (O.) Street Railway	100	47	50
Jersey City, Hoboken and Paterson	100	20	23
New Orleans City Railway, com	100	28	30
do. do. do. do. pref	100	101	105
North Jersey Street Railway	100	22	24
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	31	32
do. do. do. pref	100	86	87
St. Louis United Railways, com	100	26	27½
do. do. do. pref	100	80⅞	82
Detroit United Railway	100	74⅞	75¼
PHILADELPHIA.			
American Railways	50	40¾	41
Citizens	50	359½	360
Columbus Railway	100	40	40¼
Columbus Railway, pref	100	84½	85
Consolidated Traction of New Jersey	100	67¾	68
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	24	24½
do do pref	50	62	62½
Dayton Traction	100	156	156¼
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151¼
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	95½	96
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	27¼	28
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	178½	179
West End Street, com	50	94	94¼
do. do. do. pref	50	112	113
CHICAGO.			
City Railway	100	209	210
Lake Street Elevated	100	13	13¼
North Chicago	100	190	200
Union Traction, com	100	16⅞	18
do. do. pref	100	58½	85¼

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	24	24
do. do. do. pref	50	95¼	94
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	49	50

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Electric Boat, com	100	16	19
do do pref	100	40	50
Electric Lead Reduction	100	2	2¼
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	3	4
do do pref	100	4	5
General Carriage	100	1	1⅛
General Electric	100	258¼	258⅜
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	250	251
General Electric	100	258	258¼
Massachusetts Electric Companies, com	100	35	35¼
" " " pref	100	92	92¼
Westinghouse Electric & Mfg., com	50	72	72¼
do do do pref	50	80	80½
CHICAGO.			
Chicago Edison	100	165	165¼
National Carbon, com	100	18	18¼
do do pref	100	84	84¼
PHILADELPHIA.			
Electric Company of America	50	6⅞	7
Electric Storage Battery, com	100	..	70
do do do pref	100	..	70
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	5⅝	5¾
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	93	94
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
BOSTON.			
American Telephone & Telegraph Company	100	162½	162¾
Erie Telegraph & Telephone Company	100	41	41¼
New England Telephone Company		135	135¼
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co.	100	105	110
Commercial Cable Company	100	180	185
Franklin Telegraph Company	100	45	54
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	116	118
Mexican Telephone Company	100	2	2¼
New York & New Jersey Telephone Company	100	166	170
Pacific & Atlantic Telegraph	25	78	85
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		92¾	93
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	116
Cumberland Telephone & Telegraph Co	50	136	140
Chesapeake & Potomac Telephone Company	100	60	65
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		75	76
Hudson River Telephone Company	100	115	120
Northwestern Telephone Company, guar	50	124	126
Providence (R. I) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Sept. 30

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1⅛	1⅝
Eddy Electric Manufacturing Company	25	10	10¼
Storey General Electric	10	11	12
Consolidated Car Heating	100	55	57
Standard Underground Cable	100	218	220
Pratt and Whitney, pref	100	87	88

STREET RAILWAY BONDS.

	Last Sale.	Int. Paid.
ALBANY.		
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116¼	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109¼	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100¼	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅞	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105⅞	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅝@16¾c.; Lake, 16¾@17c.; casting, 16½@16⅝c.

The strike on the South Side Elevated Railroad in Chicago has collapsed.

C. T. Yerkes announces that he finds the Ganz system unsatisfactory for his London lines.

A Baltimore syndicate has succeeded in consolidating the rival street railway interests in Atlanta, Ga.

A receiver has been appointed for the Woods Motor Vehicle Company of Chicago on account of unpaid wages.

The Monongahela & Birmingham Traction has been leased to the Consolidated Traction Company of Pittsburg.

The annual report of the Brooklyn Rapid Transit Company, ready in about ten days, will be, it is claimed, very favorable.

Interest and dividend payments in Boston in October aggregate $12,541,866, compared with $15,673,874 in October, 1900.

The Central and South American Telegraph Company has declared the usual quarterly dividend of 1½ per cent., payable October 8.

It is believed in New Orleans that H. H. Pearson, jr., and his associates will secure control of the New Orleans City Railroad Company.

The New York State Railroad Commissioners are considering an application for a four-track electric line from New York to Port Chester.

According to Chicago dispatches, it is officially announced that dividends of Chicago Union Traction preferred stock will not be resumed this quarter.

The Mexican Telegraph Company, has declared the regular quarterly dividend of 2½ per cent-, payable October 15. Books close October 8 and reopen October 16.

A dispatch from Scranton, Pa., says a general strike is threatened on the traction lines in the Lackawanna Valley, on account of the discharge of two conductors.

So far, this year's earnings of the St. Louis Transit Company are $3,801,409 as against $2,657,716 last year. The earnings are equivalent to 1½ per cent. quarterly interest on the common stock.

American electrical engineers have scored another victory in London. J. G. White & Co. have been awarded a contract to build the corporation tramways of Bournemouth at a cost of $760,000.

The Pennsylvania Telephone Company has arranged to issue $1,144,400 stock to take over the Central Pennsylvania Telephone & Supply Company. The transfers cover 37 counties with between 20,000 and 30,000 instruments.

It is estimated that the October dividend disbursements on industrial securities will be $20,707,547, against $19,463,034 for September. It is also computed that the dividend payments for the first ten months of the present calendar year will be $20,756,705.

Control of the Telephone, Telegraph and Cable Company of America passed into the hands of Charles W. Morse, of the American Ice Company, Monday. Mr. Morse was reported to have exercised his opinion on more than two-thirds of the stock. Experts had been at work on the books for three weeks, and their reports to Mr. Morse are said to have been satisfactory.

The copper shares were heavy on Monday in Wall street and large blocks were sold. As the Amalgamated, the Anaconda and the Parrot Copper companies have all made reductions in their dividends, it is regarded as probable that other companies, owned or controlled by the Amalgamated Company, will also make reductions in their dividends from time to time, as they become due.

The Frontier Telephone Company was incorporated at Albany, N. Y., on Monday with a capital of $500,000 to connect New York, Albany, Rochester, Syracuse, Tonawanda, Niagara Falls, Lockport, Dunkirk, Erie, Cleveland, Jamestown, Hornellsville, Elmira and Binghamton. The directors are: James M. Thomas of New York, Irving A. Stearns of Wilkes-Barre and E. Clufkin of Buffalo.

The following street railroads of Utica, N. Y., have been consolidated: Utica Belt Line and Suburban, Utica and Mohawk, Utica and Deerfield, Oneida Street Railroad and Herkimer, Mohawk, Ilion and Frankford Railroad. The name of the consolidated company will be the Utica and Mohawk Valley Railway, and the capitalization will be $3,000,000. All the stock has been taken by the incorporators.

The annual meeting of the Boston Edison Electric Illuminating Company will be held October 8. Stockholders will be asked to approve an issue of $750,000 additional stock, to be issued at the ratio of 1 share for 10 and at a price to be fixed by the gas commissioners. The new stock is to cover expenses of extensions the past summer. Of the 30,000 shares of Boston Electric Light Company stock 29,500 shares have been deposited with the Old Colony Trust Company under terms of consolidation with the Edison Company.

At a special meeting of the directors of the Worcester (Mass.) Traction Company held Friday in Newark, N. J., resolutions were adopted to decrease the preferred stock from 20,000 to 400 shares and that the 19,600 shares of preferred stock previously called for redemption be cancelled. The resolutions give notice of a meeting of the shareholders for October 7 to take action on the directors' recommendation. President Thomas C. Barr said that the directors' action is one of the final steps in winding up the company's affairs.

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THE TRADE SUPPLIED BY
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EDITORIAL NOTES.

The Meeting of the American Street Railway Association. The Convention of the American Street Railway Association, which opens to day in Madison Square Garden of this city, promises to be a most interesting and instructive affair. The papers that will be presented are on subjects of timely importance to the profession and should be the means of eliciting valuable discussions.

Among other things, it is expected that the Committee on Standards will make a report. This committee was appointed to consider rails, electric motors with a view to standardizing all parts of the motor, to consider single truck and double truck car bodies as well as the standardizing of overhead material.

Thursday, October 10, has been set aside for examining the many exhibits that will fill the Garden and consequently on that day no session will be held.

Elsewhere in this issue will be found a list of the papers to be presented and the various committees.

* * *

The Condition of the Brooklyn Bridge. The report of Messrs. Duryea, Jr., and Mayer on the Brooklyn Bridge, which was made at the request of District Attorney Philbin, has been given the public, and indicates a most unsatisfactory condition of affairs to say the least. In the first place, according to the engineers who inspected the structure, the bridge is over-loaded and the factor of safety extremely small, and in the second place, the method of inspection has not been thorough enough. It is gratifying to note, however, that electrolysis—which is frequently used as a cloak for a multitude of sins—is not or has not been at work, for the report says:

"Electrolysis has often been mentioned in newspapers as a possible cause of weakening of the bridge. This is merely a form of rust caused by electricity under certain conditions, and there is no evidence that these conditions exist in the bridge."

The experts recommend that the bridge be strengthened at a cost of $750,000. The work of making the structure absolutely secure and safe cannot be gone ahead with too quickly to please the citizens of Manhattan and Brooklyn.

* * *

The British Association Meeting at Glasgow As we anticipated in a recent article in Electricity the Glasgow meeting of the British Association has been quite unimportant from a practical electrical engineering standpoint. The presidential address by Prof. Rucker, dealing with atomic theories opened the procedings on Wednesday evening, September 11, and the following morning the different sections settled down to their own particular subjects. The Physics and Mathematical Section (A) was under the control of Major MacMahon, and Section G, now known as the "Engineering Section," was under the presidency of Colonel Crompton. In the latter section it might have been thought that the address would deal practically and enthusiastically with electrical engineering work and development. As a matter of fact its main feature was that it emphasized the importance of the motor car in dealing with the street traffic of the future. After some reference to the work of Americans and Continentals in the direction of high speed electric railways, Colonel Crompton dwelt upon the street traffic problem somewhat as follows: "A most important problem in locomotion was that caused by the congestion of street traffic in our towns, and by the undoubted difficulties which existed in carrying our workers to and from their homes in the country to their places of employment in our towns. The number of our working population that used the cycle for going to and from their work was already very large and was steadily increasing. Then came the motor car. After many years of objecting to the use of the overhead trolley system, our town authorities seemed now to have determined that the only way of relieving street traffic was by an enormous development of electrical tramways." The speaker then added that it seemed opportune to point out that a great deal of mischief might accrue from this indiscriminate use of tramways. Of course, where the roads were rough and bad, anything in the nature of a tramway using rails was an improvement on a roadway, but with cities which already possessed well laid out and well paved streets it seemed wrong to break up the surface of these streets for the purpose of laying tramways. Vehicles on the plain road surface could overtake a stopping or a slower vehicle going in the same direction without interfering with other vehicles, but street tramways must stop to set down and take up passengers, and this limited the speed average and the number of vehicles.

Colonel Crompton stated that in America and on the Continent it was generally admitted that the maximum carrying capacity of an electrical tramway in one direction was 4,000 passengers per hour past any given point. A full gauge suburban or metropolitan railway crowded to its fullest extent could not carry more than 12,000 passengers per hour. But with crowded omnibuses, almost touching one another, and yet going at a fair rate of speed, at eight miles per hour, 14,000 passengers could be carried from a given point per hour. Continuing the speaker said: "It appears certain, therefore, that, although the provision of electrical tramways was undoubtedly an economical means of carrying passengers, yet that these tramways could not be laid in existing thoroughfares without considerably reducing the total road carrying capacity at times of heavy pressure of traffic, and it appeared likely that either for the daily transport of the workers to and from their homes to places of employment, or for taking great crowds out into the country for pleasure purposes, a motor car service carried out on well made roads, would compete favorably with, and in many ways may be preferable to tramway service. The increased road and street traffic and the development of new means of road locomotion has made imperative some modification of our existing system of roadway administration. Cycles, motor cars, electrical tram cars had been invented and put on roads maintained and worked exactly as they were seventy years ago at the commencement of the railway era."

Colonel Crompton concluded by saying what was needed was that towns situated on main through roads, should provide alternate routes, so that through travelers could if they desired avoid the crowded streets of the town.

Foreign competition, and the necessity for more general adoption of standardization methods as in America, were the other points touched upon by Colonel Crompton.

* * *

Markets for Electrical Apparatus.

The commerce of the United States with Cuba and Porto Rico, while it has always been a subject of great interest and importance, is becoming more important year by year and day by day. As nearby markets for the products of our electrical factories they exceed in value those of many other and more distant countries having a vastly larger population. The growing disposition of the Cubans and Porto Ricans to trade with the United States is illustrated by some figures prepared by the Treasury Bureau of Statistics, showing the exports to those islands during the last two fiscal years. It is shown that the exports of electrical machinery to Cuba increased from $5,825 in 1899 to $95,093 in 1900, while the exports of instruments and apparatus for scientific purposes, in which are included telegraph, telephone and other electric apparatus, increased during the same period from $98,386 to $218,307. The volume of exports to Porto Rico is not so great, but it is growing with gratifying rapidity, the exports of electrical machinery increasing from $3,715 in 1899 to $5,788 in 1900, while those of instruments and apparatus for scientific purposes increased from $12,743 to $32,392.

These increases will no doubt be noted with satisfaction on the part of the electrical fraternity, and should serve to emphasize the belief that the developments of the past two years will not only stimulate and increase the business activity and consequent purchasing power more and more of the islands, but increase the share of the United States in that commerce.

In this connection it can be stated on the authority of the War Department that there will probably be no change in the Cuban tariff. The commission which has been revising the present tariff has not yet reported, and it was stated at the War Department that such good progress is being made on the formation of a Cuban Government that the revision of the tariff for Cuba probably will await action by that Government.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

August Belmont, president; John B. McDonald, contractor; E. B. Bryan, general superintendent; S. L. F. Deyo, chief engineer; L. P. Stillwell, electrical director, and J. Van Vleck, mechanical engineer of the Rapid Transit Subway Construction Company, sailed for Liverpool on the Campania Saturday. They will make a tour of the cities of England and the Continent where the subway system is in operation. They will look into the operation of the systems, the kinds of cars used, equipment, and the method of handling passengers. In London the party will be joined by William B. Parsons, chief engineer of the Rapid Transit Commission. They expect to return on the Oceanic on the 30th inst.

◆

The Canadian Niagara Power Company, which will build a large electric power plant on the Canadian side at Niagara Falls, has awarded the contract for the tunnel and portal. The price is over half a million, and the work is to be completed by January 1, 1903. The tunnel will be 2,200 feet in length, and 19 x 21 feet in diameter. It will be bricked throughout the same as the tunnel on the American side. The shaft has been sunk the required depth, and the contractor will immediately commence the work of excavating the tunnel.

◆

The City Council of Savannah, Ga., by a practically unanimous vote, declined to pass an ordinance for the separation of the races on street cars.

◆

A cable dispatch from London says the opinion of Charles T. Yerkes regarding English railways is that they must be taken in hand by Americans and worked in their way, or else they will break down under enormous capitalization and wasteful method. A mass of tables issued by the British Government last week on railways in the United Kingdom in 1900 is unpleasant reading for the shareholders, showing increased working expenses out of all proportion with the increase in receipts. Of the total paid up capital of £1,176,000,000, 16 per cent., or £187,000,000, is due to nominal additions on consolidation, conversion, and division of stocks. The average rate of dividend is only 3.45 per cent., as against 3.67 per cent. in 1899. It is the realization of these shortcomings which has induced the departure for New York of several prominent officials of the Northeastern Railway Company, including George Gibb, the general manager, and Mr. Burtt, the traffic manager, who sailed on the steamer Celtic on the 4th inst., the object of their trip being a month's study of the American railroad system.

◆

The members of the committee on electricity and electrical appliances for the St. Louis, Mo., Exposition, held a meeting recently. The work of the committee is to be taken up and prosecuted vigorously. A conference of the executive committee will be held soon, and certain details of the work of the committee may be outlined. The question has not yet been decided whether the Exposition will operate its own electrical plant, as was the case at Chicago, or make this a matter of concession. In the former case, the work of the committee would be materially increased, a greater amount of funds would be needed, and numerous appointments would have to be made.

◆

The Atchison, Topeka & Santa Fé Railway, is making a practical test of using telegraph wires for telephone and telegraph purposes simultaneously. An experimental line, two miles in length, between Leavenworth and South Leavenworth, Kan., has been equipped under the supervision of Mr. C. G. Sholes, superintendent of telegraph. Test lines will be put in place at various points on the Santa Fé system, and the practicability and cost of the invention in actual service will be determined.

◆

The International Telegraph Bureau at Berne, Switzerland, recently issued a comprehensive report, furnishing some interesting data with regard so the submarine cables of the world. At the present time there exists as many as 1,380 Government cables, with a total length of 24,907 miles. There are also 370 cables owned by private companies. These give a total length of 198,929. So that altogether there are 1,750 cables in existence, with a mileage of 223,836.

◆

The "Journal of the Franklin Institute," Philadelphia, on the general subject of solders for aluminum says that the one great drawback to the application of aluminum for a large number of uses in the arts for which its lightness, color, resistance to oxidation and the ease with which it can be rolled, drawn into wire, pressed and spun up into various shapes, etc., is the difficulty of soldering joints. While some approximations have been made to a durable solder, among which that of Richards' should be named, it is nevertheless true that an entirely satisfactory solution of the problem has yet to be found. The difficulties encountered are three-fold: 1. The high heat conductivity of aluminum, which abstracts heat rapidly from the joint, and. 2, galvanic action between the aluminum and the metals of the solder by which the aluminum, the more electro-positive metal, is corroded and the joint destroyed. It is very easy to make an apparently perfect soldered joint of aluminum with various mixtures of zinc and tin, for the reason that when freshly made the adherence is all that could be desired. The effects of the galvanic corrosion may make themselves apparent after the work has been exposed to atmospheric influences for some months. The rapid heat conductivity of the metal can be practically obviated by applying artificial heat to the joint while the solder is being applied. It has been proposed to use aluminum in considerable proportions in the solder to avoid the effects of galvanic action, but while this artifice might accomplish the desired result the joint cannot be made with the soldering iron, because of the high heat required to melt the alloy. A perfect solder for aluminum is still to be found.

While the Rigi, situated near Lake Lucerne in Switzerland, is now recognized as the most thronged and popular mountain in Europe, one would have thought that two railways to its summit were quite enough. It appears, however, that there is the prospect of a third Rigi railway, in addition to the Vitznau-Rigi line and the Arth-Rigi line. Surveys are now being made by the engineer for the construction of a rack-and-pinion line from Weggis to the Rigi-Kulm, with only one intermediate station, which is to be at Kaltbad. The third railway will differ from the two already in existence in that electricity will be made use of as motive power instead of steam.

It is officially stated that the Cunard steamship Umbria is now fully equipped with the Marconi system of wireless telegraphy. The Lucania and Campania have already been fitted with this system, and it will be introduced on the Etruria within a short time.

An incident near Marion, Kan., indicates the superiority of the electric headlight. It was the means of preventing the wrecking of a southbound Rock Island train near that point. Two mules had attempted to cross a bridge and were caught between the ties at about the center. The gleam of the electric headlight disclosed the struggling mules to the view of the engineer in time to stop the train.

George W. Roosevelt, the United States Consul at Brussels, writes to the State Department at Washington concerning the utilization of electric power in the coal mines of Belgium. He says: "One of the most important coal mines in the Charleroi district has concluded arrangements for the erection of a central station which will supply electric motor power for three mines now in operation, situated several kilometers distant from each other. The pumps are placed at the bottom of the pits, at a depth of 500 meters. The station furnishing the power is on the surface and is composed of powerful steam engines of modern construction turning large electric dynamos. The electric current which feeds them all is produced in the generating station, and is transmitted over a considerable distance by means of three small wires only a few millimeters in circumference mounted on poles, then conducted into the pits by a cable sheathed in steel. This method replaces that of the direct traction pump, with shaft weighing thousands of kilograms and exacting a special exhaustion well, and only giving five or six piston strokes per minute. The electric pumps give from 150 to 200 and even more strokes per minute, and occupy very little space in the gallery. Electric pumps offer the advantages of requiring less expenditures in placing them, less trouble to keep in order and of being safer and much more economical as regards consumption of steam. Another advantage is that they do not conduct steam into the pits, a source of great vexation on account of resulting leaks, condensation of water, deterioration of work, great heat, etc. It is also claimed that the electric power may be employed in operating the windlasses of the mines, machines employed in washing and sorting, small cars, and for illuminating purposes. The centralization of motor force in coal mining—that is to say, the suppression of numerous small boilers and steam engines—will result in great saving of fuel."

An English contemporary states that in a month or two the British Admiralty will commence a series of experimental tests with a view to the extension of the use of electricity for subsidiary purposes on warships. In practically all the men-of-war at present afloat the capstan, steering engines, ventilating fans, and the derrick hoists are worked by steam power. It is in regard to the controlling of this class of plant that the impending tests will be made. The cruiser "Hogue," now being completed at Devonport, is being equipped with an extensive electrical plant, and all the auxiliary gear will be worked by electricity in addition to the gun and torpedo armament. It is probable that the tests will be conducted on board this vessel, which will shortly be ready for sea.

An electrical letter stamping machine has been installed in the post office at Lebanon, Pa.

Very shortly Italy will be in possession of its first international telephone connection, says the London "Electrical Engineer." The new line is almost completed, and runs between Milan, Turin, and Paris via the Mont Cenis. A few months later will witness the inauguration of a second international telephone line between Milan and Zurich. There only remains now to be constructed a comparatively short section between Como and Chioasso on the Swiss frontier. The establishment of these lines will have the effect of placing Italy in telephonic communication with London by way of Paris, and with Berlin through the Zurich line. It is rumored, however, that negotiations will shortly be entered into with a view to the construction of a direct telephone line between Milan and Berlin. Many improvements in the inland telephone and telegraph service are also reported to be engaging the attention of the authorities in Italy.

The contract for the electrical equipment of the main power house and subway stations of the Rapid Transit Railroad of this city has been awarded to the Westinghouse Company.

Towing by electricity along the river banks in England is quite a novel application of electric power. The experiment is to be tried, however, in the northern suburbs of London. The River Lea, which runs through Walthamstow, Tottenham, Enfield and numerous other places in that district is quite a busy little river with considerable barge traffic and it is now proposed to develop this traffic and stimulate manufacturing industries along the river banks by introducing a system of electric towing. It is stated that no electrical apparatus whatever will be used on the barge itself, which is to be connected by rope with an electrically propelled vehicle on the path working on the overhead trolley system.

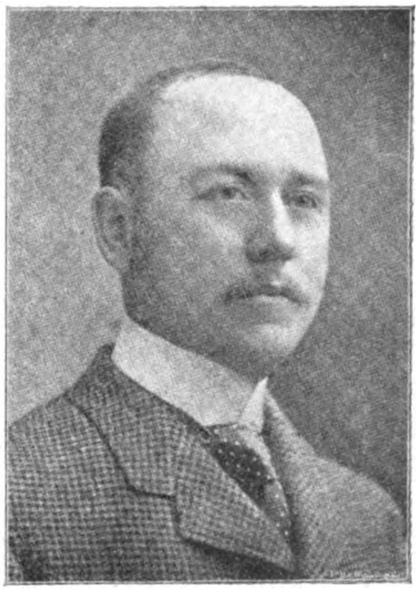
THE AMERICAN STREET RAILWAY ASSOCIATION CONVENTION.

The American Street Railway Association will hold its convention in New York City on October 9, 10 and 11. While the headquarters of the Association will be the Murray Hill Hotel, the meetings will be held in Madison Square Garden, which will also contain a large number of exhibits of interest to street railway men.

The programme includes the reading of the following papers:

"Street Railways: A Review of the Past and a Forecast of the Future." By Robert McCulloch, general manager Chicago City Railway Company, Chicago, Ill.

"The Adoption of Electric Signals on Suburban and Interurban Railways, Single or Double Track, and Their Economy of Operation." By William Pestel, superintendent of motive power Worcester Consolidated Street Railway Company, Worcester, Mass.



W. H. Holmes,
President of the American Street Railway Association.

"The Values of Storage Batteries as Auxiliaries to Power Plants." By W. E. Harrington, vice-president Camden & Suburban Railway Company, Camden, N. J.

"The Public, the Operator and the Company." By C. S. Sergeant, vice-president Boston Elevated Railway Company, Boston.

"The Best Manner and Mode of Conducting the Return Circuit to the Power House." By E. G. Connette, vice-president and general manager Syracuse Rapid Transit Railway Company, Syracuse, N. Y.

"The American Street Railway Association: The Purpose of its Organization and the Benefits Accruing to Investors in, and Operators of Street Railway Properties by Membership Therein." By G. W. Baumhoff.

"The Economies Resulting from the Use of Four Motors Instead of Two on Double Motor Equipments."

"The Best Form of Car for City Service: A Consideration of the Various Types of Car as to Size of Car and Arrangement of Seats, Including Best Types of Brakes and Wheels." By Eugene Chamberlain, superintendent of equipment Brooklyn Rapid Transit Company, New York City.

Relations of Interurban and City Railways." By Ira A. McCormack, general manager Cleveland Electric Railway Company, Cleveland, O,

COMMITTEES.

The exhibit committee is made up as follows:

Milton G. Starret, chief engineer Metropolitan Street Railway; Oren Root, Jr., assistant general manager Metropolitan Street Railway; C. D. Meneely, secretary Brooklyn Rapid Transit Company; Eugene Chamberlain, superintendent of equipment Brooklyn Rapid Transit Company; Calvert Townly, Westinghouse Electric & Manufacturing Company; Charles M. Jarvis, vice-president American Bridge Works; J. R. Lovejoy, General Electric Company; Capt. L. Candee, Okonite Company.

The following gentlemen will compose the entertainment committee:

J. L. Greatsinger, president Brooklyn Rapid Transit Company; H. D. Cooke, president Compressed Air Company; Ralph H. Beach, General Electric Company; Edward E. Higgins, "Success;" W. Boardman Reed, engineer maintenance of way, Metropolitan Street Railway; Maj. H. C. Evans, Lorain Steel Company; F. H. Taylor, Westinghouse Electric & Manufacturing Company; E. A. Merrill, McIntosh & Seymour Company; Thomas C. Wood, Ball & Wood Company; James C. Barr, Weber Rail-Way Joint Manufacturing Company; H. Webster, Babcock & Wilcox Company; H. M. Littell; D. M. Brady, president Brady Brass Company; Charles F. Brooker, president Coe Brass Company; C. B. Fairchild, Jr., "Street Railway Review;" Col. H. J. Prout, "Railroad Gazette."

T. C. Penington,
Secretary of the American Street Railway Association.

The general committee of the American Street Railway Association is composed of the following gentlemen:

H. A. Vreeland, president Metropolitan Street Railway; Clinton H. Rossiter, David Young, vice-president North Jersey Street Railroad; Col. N. H. Heft, president Meriden Electric Railroad; Edward A. Maher, president Union Railway; D. B. Hasbrouck, vice president Metropolitan Street Railway; A. M. Young, president Bridgeport Traction Company; John R. Beetem, vice president New York and Queens County Railway; E. P. Bryan, General Manager Subway; Alfred Skitt, vice-president Manhattan Railway; James H. McGraw, Street Railway Publishing Company; Gen. Eugene Griffin, General Electric Company; B. H. Warren, Westinghouse Electric and Manufacturing Company; Harry Sanderson, president New York Electric Transportation Company; Frank J. Sprague, Sprague Electric Company; Henry L. Shippy, treasurer John A. Roebling Sons Company; John L. Heins, president Coney Island and Brooklyn Railroad.

METHODS OF COMMUNICATION IN ELECTRIC GENERATING STATIONS.*

A very large proportion of the accidents which occur in electric generating stations is due either to attention not having been drawn in time to certain occurrences, or to insufficient means of communication between charge engineers and their men. That this is so does not necessarily reflect discredit on those responsible for the design or management of these stations, as the supply of electricity is so decidedly a "hand-to-mouth" concern, that means of observation and communication must be very efficient in order to insure success. Under these circumstances it is interesting to note the various methods of signaling and communication in vogue in such stations. For the purposes of this article a signal may be defined as a device or motion that gives notice or conveys information in a prominent manner.

In a small station the plant is usually grouped closely together, well under the observation of the engineer in charge of it. The men are also few in number, are close at hand, and are generally well in touch with their chief and their work. In these stations the need for signals is small, as the necessary information can be gained from direct observation of the machinery and measuring instruments, and conveyed by word of mouth. As a station grows in size, however, it becomes more and more necessary that information should be conveyed to a common center, from which center instructions should be sent out again. This is imperative if any one man has to assume responsibility for the running of the plant. In this way automatic and manipulated signals become of increasing necessity as the station grows larger. It is intended in this article to describe a few of the signaling arrangements which have been adopted in various large stations.

It will be well to consider, first, those signals which draw attention to occurrences; and secondly, those which convey instructions. It is, however, necessary to remember that there is no distinct division between the classes.

It is frequently the case in large stations that while care has been taken in the design to have engines and boilers conveniently placed for observation and working, other parts of the plant, no less important, are crowded away into odd corners in order to economize space. This particularly applies to water tanks, such as hot wells, reserve feed water supply, or circulating water reservoirs in connection with cooling towers. The failure of supply from these tanks would mean disaster. Everyone knows the result of shortness of water in a boiler, and no station engineer will view the failure of condensing water on heavy load with anything but dismay. It is clear, then, that in addition to the ordinary water-level indicator a prominent signal should be given in the boiler house whenever the water is dangerously low in these tanks. A very effective device in use for this purpose is an electric contact in circuit with a battery and loud-ringing bell, the contact being actuated by a float on the surface of the water, and set so as to make connection when the float has sunk to a certain level.

In many modern generating stations quick-steaming boilers are in use. In these, the water-level is likely to rise and fall very rapidly, and unless careful attention be paid, the boiler may be ruined through shortness of water, or the steam pipes and engines may be wrecked through water coming over into them. It is therefore standard practice among boiler makers to include among their fittings a high and low water alarm whistle. The whistle is blown by steam from the boiler, this steam being admitted, both for high and low water, by the action of a float or floats in the interior of the drum. The fireman is thus warned to look more closely at the water gauges, a warning very necessary in a boiler house containing, perhaps, 20 or 30 gauges, probably well above eye level and insufficiently illuminated.

These two general methods—the electric bell signal or the steam whistle—are used in various special cases in connection with steam-raising plant, which cannot be entered into in detail here. A warning is, however, necessary against increasing the number of such signals indefinitely, either in boiler or engine houses. The drivers and stokers are paid to look after the plant, and too many precautions may give a false feeling of security. Also, in time of emergency confusion may arise in the minds of the men owing to a multiplicity of automatic signals being given at the same time.

Trouble has occasionally ensued because steam and water valves have been thought to be open when they were closed, or vice versa. For this reason some station engineers have taken the precaution to so arrange all important valves that they show conspicuously whether they are open or shut. Some valves have external threads which can be seen in one position and not in the other; others have guide-blocks which move with the valve. Whatever the indicator may be, it should be painted or otherwise made as conspicuous as possible. Where there is no external signal it is an easy matter to arrange one, geared or linked to the handle or valve stem. It does not appear to be a satisfactory plan to provide tablets to be attached by hand to the valve with "open" or "shut" upon them, owing to the probable negligence of the men.

It is, however, in the running machinery and electrical equipment more than in the steam-raising portion of the plant that the need for signals arises. Except in extreme cases, there is always a minute or two to put matters right in the boiler house. In dealing with the running machinery the time available to avert a catastrophe is often to be reckoned in seconds. As an example of the necessity of signaling arrangements in this work, the general practice may be mentioned of providing a synchronizing lamp in full view of the drivers in alternating-current stations, so that they may run up their engines to exact speed without loss of time. A variation of this practice is adopted in some stations where alternating current arc lamps are used. Conspicuous marks are painted on the rotor of the alternator. When the machine is slightly under speed these marks appear to revolve backwards. They appear to go forward when the speed is too high, and at exact synchronism they seem to stand still. In some single-phase high-tension stations it is customary for the switchboard attendant to synchronize by means of a single lamp instead of a voltmeter. Messrs. Siemens & Halske have devised an extension of this lamp signal (using three lamps) for three-phase work, by which one is enabled not only to tell when two machines are in phase, but also, if this is not so, whether the incoming machine is revolving faster or slower than the synchronizing speed.

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*From the "Electrical Review," London.

Another application of the incandescent lamp as a signal is found in the "earth" detector common in low tension two-wire stations. Two lamps are connected in series across the bus bars (which are normally insulated from earth) and a connection to earth is made from the wire joining the two lamps. Hence if both halves of the system be perfect, a current will flow through the signal lamps in series, causing them to burn with an equally dull red glow. If, however, there is an earth on either side, the lamps will be subjected to unequal pressures, and one will burn more brightly than the other. The "earth" is of course on the branch opposite to the brightly-burning lamp. This device has also been applied to the field circuit of high tension stations, when the machines are excited from a common source.

In high tension alternating current stations the following modification of the incandescent lamp signal has been adopted with some success. A Geissler tube is connected between the high tension cable and earth. So long as the pressure is maintained the tube shows a bluish light. Should the insulation break down, the light is extinguished. This is particularly useful in three-phase work, as one is enabled to tell at a glance which of the three branches is at fault. The tube also incidently solves a difficulty occasionally met with in practice—the fact that fuses sometimes fail very quietly, and therefore no attention is paid to the interruption of supply until complaints begin to arrive. In order to make the Geissler tube of value in this way, its point of connection should be on the cable side of the fuse—not between the fuse and the bus bar.

On a switchboard with a large number of distributing panels it is an easier matter than would at first sight appear to overlook the failure of a fuse. For this reason it is desirable, other things being equal, to adopt a fuse that makes a noise when it goes. Fuses which depend on the expansion of heated air within a fuse-pot (either wholly or partially) to blow out the arc invariably make a bang when the fuse melts, the noise forming a signal to the attendant which cannot be disregarded.

In direct current work automatic circuit breakers are to a large extent replacing fuses, more especially in combined lighting and traction stations. These have a trick of coming out quietly, and an additional signaling device is useful where more than five or six cut-outs have to be watched. A very good method which has been adopted is to so arrange an auxiliary switch on the base of each circuit breaker that the thrust of the cut-out handle, when the contact is broken, closes the circuit of a bell and indicator system. The circuit breakers should be boldly numbered in conformity with the numbers of the indicator drops, and a reference table of circuit breakers and numbers kept beside the indicator board.

In low tension systems a ready means of signaling the failure of a fuse, where this is inconveniently placed for inspection, is to place an ordinary glow lamp in shunt with the fuse. At the failure of the fuse the potential of the cable in all probability drops considerably, while that of the bus-bar remains the same. A current therefore flows through the lamp, due to the difference of pressure between its terminals, and the glow attracts the attention of the man in charge.

In high tension stations, whether continuous or alternating current, there should be a permanent danger signal on all wires at high potential. This is usually effected by means of painting such wires a distinctive color. This is not entirely satisfactory, as one is never sure whether the cable is really alive or not until one has traced the connections. The suggestion may perhaps be permitted that there is without doubt a fortune awaiting the man who invents a paint or other covering for a cable which can indicate by change of color or otherwise when the potential of the cable which it covers exceeds the limits of safety to life. Unfortunately, there appears at present to be no clue upon which to work in this direction.

Turning now to the important class of signals designed to convey instructions, it will be found that the chief points inside a station between which rapid communication is necessary are the switchboard and engine room. This is particularly the case in alternating current stations, where the operation of synchronizing has frequently to be performed in the utmost hurry; but it is also true for direct current stations. It will be found that nearly every station has its code of signals between switchboard attendants and drivers, often consisting in its simplest form of pointing with the finger at an engine and an upward or downward motion of the hand, varying in vigor in accordance with the amount of alteration required. This is enough for a small station, but quite inadequate in a large one. Perhaps the most legitimate outcome of this system can be seen at a station in the metropolis, where, after a preliminary whistle to attract attention, the deaf-and dumb alphabet, with various supplementary signs, is used. Apropos of this, it is well to remark that whistling or shouting in an engine room, except according to a prearranged plan, should be strictly put down.

In order to indicate which engine is to be run up, the signal in a large provincial station is a light board mounted on a handle with a figure painted prominently on it, this figure corresponding with the number of the engine. A gong is sounded to attract the attention of the drivers, the board is held up, and a motion of the other hand completes the message. Another useful method is to have a colored lamp fixed to each engine, which can be lit by a numbered switch on the board when anything has to be done on that engine. A signal bell completes the equipment.

A rather more elaborate system is suitable for use in a station where the switchroom is partitioned off from the engine room. A large dial is fixed on the wall of the engine room, on which the numbers of the engines are painted in the manner of the hours on a clock face. A pointer moves round this dial, being actuated through bevel gear and iron rods by a handle in the switchroom. This handle moves round a similar horizontal dial, marked in the same way as the engine room dial, and the handle and pointer are so fixed that the same number is indicated on both dials. A similar pair of dials with "Slow," "Fast," "Right," "Stop," on them, and an electric gong to attract attention, completes the arrangement.

In stations where machines are run in parallel, it is very often the custom to run on the stop valve, the load being shifted on or off the engine by the driver opening or shutting the valve. At times of variation of load (such as on the "peak") a driver will have to be in constant attendance at the engine to open or shut the valve as required. In order to get perfect smoothness in the running, a very good system has been adopted of placing two bell pushes on a bench immediately below the main voltmeter, one actuating a high-toned, the other a low-toned bell. A stroke on the high-toned bell means that the driver is to give more steam to the engine which he is regulating. The other bell signals the reverse. Thus a man watching the voltmeter is able at once to give the necessary direction to the driver. The signal gong system has in some places been extended into an elementary code, one ring, for instance, meaning "attention," two rings "lower speed," etc.

It is very often necessary to give more complicated instructions than can be transmitted by the above methods. It is necessary, therefore, in large stations to have a more complete system of communication, such as is afforded by a telephone system. A station should be fitted with a private telephone exchange on the switchboard, the points to which communications are most frequently sent being connected with this center. These points will generally be found to be the chief engineer's office, the mains superintendent's office, the boiler house, and the stores. It is a matter of some difficulty, however, to get a telephone to work well in a boiler house, owing to the amount of coal-dust, moisture and ash flying about, and the liability to rough treatment from the works hands. The telephone should be fixed in a quiet place, and a loud-ringing bell used as a signal.

The mains department should also be fitted with a private telephone exchange communicating with the switchboard, the chief's office and each sub station. The station should in addition be on the general telephone exchange of the town, and loud-ringing signal bells should be placed in the mains engineer's office and on the switchboard, in addition to the usual call-bell in the clerk's office.

It will in general be found a paying investment to equip a station with complete facilities for signaling and communication, provided that no unnecessary fads are indulged in.

The Electric Locomotive and the Electrically Driven Carriage.

The conversion of railways from steam to electricity is proceeding on two distinct lines, viz., that in which the train, made up as before of carriages or trucks, is drawn by a locomotive placed in front, the only difference between it and the existing locomotive being that the locomotive is worked by electric motors and not by steam engines, and the method in which each carriage of each truck—though this latter has hardly been attempted yet—carries its own electric motor, supplemented occasionally by a single carriage without a motor, and known as a trailer. The railway man naturally, says "Colliery Guardian," adopts the locomotive at the head of his train, because he has always been accustomed to see something at the head of the train, but there are signs that the independent unit system, as it is termed, in which each carriage is quite independent of all the rest, yet in which trains of any required length can be made up, is gaining in favor. It is claimed that the independent system is more economical, because of the smaller amount of work to be done when a train has to be broken up, or to be made up. For colliery and ironworks, probably the locomotive will be the most useful, though there will be cases even there where the independent system will save a good deal of time and money by its convenience.

MISCELLANEOUS NOTES OF INTEREST TO CENTRAL STATION MEN.—VIII.

BY W. H. WAKEMAN.

Some engineers claim that a condensing engine will run indefinitely after steam is shut off, provided an independent condensing apparatus maintains a partial vacuum in the exhaust pipe, even when the throttle valve is shut tight and there is positively no chance for air to reach the cylinder. I do not understand how this can be done, and never have found anybody who could explain the philosophy of it.

When steam is shut off from the condensing engine, its momentum causes it to run longer than if no condenser was attached, but it must stop in a few minutes unless air is admitted to the steam side of the piston, or the throttle valve leaks enough steam to drive it, and it requires but little to do this when the piston does not have to work against the atmosphere.

A somewhat similar case for argument is presented when it is claimed that the valves on a cross compound engine cannot be set so as to prevent it from "racing" when all of the load is thrown off. It is easy to see how it would fail to regulate, provided the engine was not in perfect order, but in all such cases it is assumed that the machinery is not defective.

When the load is removed from such an engine, the speed is slightly increased, which at once causes the governor to assume a position that gives the shortest possible cut-off, or even prevents the valves from opening at all. If every part is in good order, no steam or air can be admitted to the cylinders, therefore the speed is reduced, and the governor allows the valves to open again, but not wide enough to cause "racing," for as soon as the normal speed is exceeded, the governor prevents the valves from opening, and this will continue indefinitely. When the speed is not controlled under these conditions the trouble is probably caused by some undetected leak which prevents the formation of a vacuum on the steam side of the pistons.

There is still a chance for more engineers in the U. S. Navy, not only because new vessels of various kinds are going into commission in the future, but owing to the fact that the service is too hard for those already engaged in the work. The duties attached to some of these situations are so arduous that many engineers collapse while trying to perform them, and must be sent to some hospital. This lowers the number fit for duty, and prevents the enlistment of others, to the detriment of the service and some measures should be adopted to overcome the trouble. We are pleased when anybody champions the cause of marine engineers, but wish that there was more to speak or write in favor of the overworked stationary engineer of to-day. Many of this class are working 12 hours per day and 7 days per week, which appears to be more than is required of any marine engineer. In some of our large cities they work 8 hours per day, which is enough, when we consider that they must be on duty 7 days per week, but this is the exception rather than the rule. Few men are able to stand the continual strain of such service for more than a few years, and it is sure to tell on even the strongest and make them grow old before their time.

If they were well paid there would be more satisfaction in it, but in many cases they do not receive as much per hour as the laborers who clean our streets, and this is certainly very unjust. Corporations who are making money rapidly for 7 days per week, should be willing to provide an extra man so that the regular engineers would work only 6 days per week.

Which is the strongest, a riveted or a welded seam in a steam boiler? We claim to determine the strength of a riveted seam by calculating the cross section of rivets taken in connection with the shearing strength per square inch, and the number of rows of them, and other data along the same line, but we cannot be sure that all of the rivets are full size for the holes may not come "fair" when a boiler is made and careless workmen may put rivets in so that their strength is reduced to one half of what it should be. There is also a chance for the plate to be cracked by the excessive use of a drift pin, therefore the actual strength of such a seam is an uncertain quantity unless we saw it made and know all of the particulars.

The welded seam may be as strong as the riveted joint, or even equal to the solid plate, but we cannot be sure of this unless it is put into a testing machine and torn apart, when its usefulness is destroyed. If this uncertainty can be eliminated it would be a valuable point in favor of the welded joint, but until this is accomplished, the riveted joint is to be preferred because there is a better chance for knowing its exact conditions.

Engineers do not openly advocate the practice of forcing boilers as much as they did a few years ago, and this is a move in the right direction, for such abuse not only shortens the life of a boiler but results in raising the cost of fuel per horse power developed.

One of the simplest plans for saving heat that I have ever heard of, is the idea of returning the hot gases, which usually go up the chimney, to the ash pit so that they may be burned over again. The only fault to be found with it is that it will not work, for a fire must have plenty of fresh air or else it will go out.

The plan of putting an exhaust fan in the smoke flue, so that it may draw the hot gases through the boiler tubes and discharge them into the air, works well in some places, and makes a chimney unnecessary, but as a rule we believe it better to dispense with machinery as much as possible, and a well designed and substantially built chimney seems to prove a very good investment.

Why is the steam jacket for engine cylinders pronounced a success in some places and a failure in others? Is it on account of natural conditions which cannot be changed, or is it due to different plans for operating the same?

I do not understand how the steam jacket can be a success in any case unless it is kept free from water, because if water surrounds the cylinder of a steam engine it is sure to absorb heat from it, and thus defeat the object for which it was applied.

If the cylinder is not jacketed or lagged heat escapes from it so fast that it can be seen, and this calls attention to the loss in a very marked way, but when said cylinder is surrounded by water, the heat can be absorbed by this water without being seen. The use of superheated steam renders the jacket unnecessary, not because the temperature of this gaseous steam is so much higher, but owing to the fact that it does not radiate heat as rapidly as saturated steam.

The enthusiastic advocates of superheated steam claim that it will do away with the use of the triple expansion engine, but the philosophy of this is not clear. A simple engine using superheated steam may be as economical as a triple expansion engine using saturated steam, although it has not yet been demonstrated in actual practice, but suppose that we admit it to be so. Why not use superheated steam in a triple expansion engine, and reap the benefits of both improvements?

This would make a complicated plant which is always an objection, but if either one of these plans are successful when used alone, why will they not prove fully as economical when used together?

Engines can be found with the cylinders so designed that the exhaust steam passes around them before it is discharged into the atmosphere, as it was evidently the design of the inventor to keep the live steam warm, but they are not economical in the use of fuel and it is not difficult to find the reason for it when we remember that the temperature of exhaust steam is less than that of live steam, therefore the former extracts heat from the latter and carries it away.

Since writing the preceding paragraph I have had some conversation with an engineer whose employer told him to feel at liberty to sit down and read as much as he chose to during working hours, as there was no objection to it so long as the plant was run the required number of hours per day and kept in good repair.

I also have the statement of a steam user who claims that he has no use for an engineer who cannot dress and act like a gentleman during working hours. He can hire a laborer to clean up the plant, repair cracks in brick work, etc., for much less than he pays his engineer, therefore he does not consider it good policy to have a high priced man doing low priced work, not only because a cheaper man can do it just as well, but he fears that if his engineer is compelled to do these dirty jobs, he will be forced to neglect his legitimate work and that would prove doubly expensive.

This is a very interesting subject both to engineers and their employers, for many good engineers have been obliged to give up their situations because they were asked to do laborers' work which made it necessary to neglect their legitimate duties and no self-respecting engineer will do that any longer than until he can get another job. It is always possible to get engineers who are apparently willing to do anything about the plant, from repairing the ashpit to painting the smoke stack, and in small plants it may be all right, but in medium sized plants it is all wrong, for all of the engineer's energies should be devoted to caring for the plant and this is also true of large plants. The employers who recognize this fact, have the best cared for, and the most economically operated plants, where everything else is equal.

RESISTANCE AND STRENGTH OF TROLLEY WIRES.*

On a subject of much interest at the present time we print below a report sent to us by Messrs. Maguire and Baucus. In this report, made by Dr. Leonard Paget to the Bridgeport Brass Company, of New York, the subject of the effect of increased resistance in a trolley line on the total working resistance of an overhead system is dealt with. It is somewhat singular that this matter has not received attention long ago, considering that the resistance of trolley wires within certain fairly wide limits has, with the customary frequence of feeders in use to-day, practically no appreciable effect upon the total resistance of the circuit, or upon the economies of a tramway system. As a matter of fact, the resistance of the trolley wire is not as a rule taken into account in the design of trolley systems. It is, however, most important, for reasons of safety, maintenance, and general operating economies, to choose a conductor for trolley circuits which combines, with a reasonable electric conductivity, great tensile strength and, if possible, an inoxidizable nature insuring an ever clean and sparkless contact for the trolley wheel, and long life to the overhead line.

The following is the report referred to above:

Referring to your inquiry as to the effect upon the working resistance of a trolley line when the resistance of the trolley wire itself is increased, I believe the following consideration will show how small is that effect even when the resistance of the trolley wire is doubled, or more than doubled. Perhaps, at first sight, it might seem that so large an increase in the resistance of the trolley wire would give a corresponding increase in the working resistance, but a little thought will show that this is not the case.

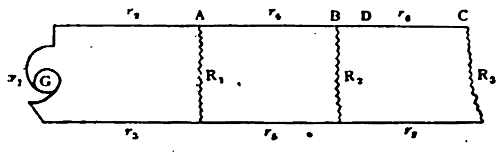
There are two points of view to be presented:

(a) that without feeders; and

(b) that with feeders.

The first (a) is more interesting than practical, and is applicable only to short lengths of lines; for feeders are a necessity, because, if the trolley wire consisted of one continuous conductor, a break in it would throw out of action all the cars, except those between the break and generating station.

Let us consider a hypothetical case, for it would be somewhat difficult to find an illustration in practice. The following diagram represents a trolley wire and three cars run from a continuous length of wire without feeders:



R_1, R_2, R_3, represent respectively each of three cars as having a resistance merely, the contrary C.M.F. of the car motors acting at a constant speed as a resistance. A, B, and C are points of contact of the trolley wheel with the trolley wire.

r_2, r_4 and r_6 are the representations of the resistance of the sections of trolley wire between the cars, or, in other words, the line-space resistance.

r_3, r_5 and r_7 are the rail space resistances (which in the calculations may be omitted).

The resistance at the point A is given by the following formula:

$$R_A = \cfrac{1}{\cfrac{1}{R_1} + \cfrac{1}{r_4 + r_5 + \cfrac{1}{\cfrac{1}{R_2} + \cfrac{1}{r_6 + r_7 + R_3}}}}$$

The calculation is more easily and instructively effected in the following manner:

The resistance at C, or R_c, is that of R_3, the resistance of the motor.

The resistance at D, or R_d, is that of $R_3 + r_6$, the resistance of the motor and of the section of the trolley wire r_6.

The resistance at B, or R_b, is a "joint" resistance, one arc of which is the motor resistance R_2, in parallel with the arc composed $r_6 + r_7 + R_3$. It is given by the formula:

$$R_B = \cfrac{1}{\cfrac{1}{R_2} + \cfrac{1}{r_6 + r_7 + R_3}}$$

The resistance at A or R_a is a further joint resistance, composed of that of the motor resistance R_1, in parallel with that of $R_b + r_4 + r_5$. It is given by the formula:

$$R_A = \cfrac{1}{\cfrac{1}{R_1} + \cfrac{1}{r_4 + r_5 + R_B}}$$

The total resistance of the system would be that of the generator G, or r_1, of the load r_2, and $r_3 + R_a$ It will be sufficient to limit ourselves to the point R_a.

We are now in a position to tackle the problem numerically, and we will first take approximate figures, merely to judge comparatively, and subsequently substitute figures obtained from practical work.

Let the voltage of the trolley wire be maintained at the ordinary voltage of 500.

Let the amperage through each motor be 50 amperes. Then because $\frac{E}{C} = R$, a resistance of $\frac{300}{30} = 10$ ohms for each car would give equivalent results to that given actually by the opposing C.M.F. of the motor and the motor-resistance; so that $R_m = 10$ ohms.

Let the electrical distances between cars (or trolley line spaces) be 1-10 ohms, so that r_4 and r_6 are each 0.1 ohm.

The rail space resistances r_5 and r_7 may be neglected as common to all calculations.

The resistance, consequently, at C, or $R_c =$ 10 ohms.

The resistance, consequently, at D or $R_d =$ 10.1 ohms.

The resistance, consequently, at B, or $R_b =$

$$\cfrac{1}{\cfrac{1}{10} + \cfrac{1}{0.1 + 10}} = \frac{1}{0.1 + 0.09901} = \frac{1}{0.1990} = 5.025$$

The resistance, consequently, at A or $R_A =$

$$\cfrac{1}{\cfrac{1}{10} + \cfrac{1}{0.1 + 5.025}} = \cfrac{1}{0.1 + \cfrac{1}{5.125}} = \frac{1}{0.29512} = 3.3884$$

These figures may be assumed to represent the resistances of a standard normal line.

Now let us double the resistance r_4 and r_6, so that each becomes 2-10 ohms. Then at C, or R_c we have 10 ohms as before, but at D, $R_d = 10.2$ ohms, and at B,

$$R_B = \cfrac{1}{\cfrac{1}{10} + \cfrac{1}{0.2 + 10}} = \cfrac{1}{0.1 + \cfrac{1}{10.2}} = \frac{1}{0.19804} =$$

5.0495, and at A, R_A becomes

$$= \cfrac{1}{\cfrac{1}{10} + \cfrac{1}{0.2 + 5.0495}} = \cfrac{1}{0.1 + \cfrac{1}{5.2495}} = \frac{1}{.2905} = 3.4423$$

Collecting the results, we immediately see the nature of the effect of doubling the resistance of the trolley wire, upon the working resistance of the line.

	$r_n = 0.1$	$r_m = 0.2$	Per cent. increase in working resistance.
At C	10.	10.	..
At D	10.1	10.2	0.99
At B	5.025	5.0495	0.48
At A	3.3884	3.4423	1.6

From this it is evident that an increase of 100 per cent in the resistance of the trolley wire under full working conditions, the increase of the working resistance with the wire dead-ended and with the whole resistance of the trolley wire in circuit is less than 1 per cent. With three similar cars on the same length of trolley wire, the working resistance has an increase of only 1.6 per cent.; while with two similar cars, which is a fair working condition on even a crowded line, on the same length of trolley wire, the increase of working resistance is less than ½ of 1 per cent.

One-tenth of an ohm represents about 1,020 feet of No. 0 copper wire, and about 1,330 feet of No. 00.

Let us now apply some figures obtained from the constructional and operating data of a very busy trolley line in New York City. This trolley line consists partly of No. 0 hard-drawn copper wire having a resistance per 1,000 ft. of .09948 international ohms at 75° F., and partly of "Phono-Electric" wire of the same diameter, having a resistance of 0.2423 international ohms at the same temperature.

The distance between feeders averages 1,250 ft., so that the resistance of the wire between feeders is 0.12435 international ohms for the hard-drawn copper wire, and 0.302875 international ohms for the "Phono-Electric" wire. In what follows the resistance taken will be 0.124 and 0.3 respectively.

The line is operated at a mean of 500 volts.

No. 49 Westinghouse motors are employed. These motors take at full load 62 amperes, at three quarter load 44 amperes, and at half load 30 amperes.

At the voltage, the equivalent resistance producing these currents would be 8.06, 11.36, and 16.67 ohms respectively. The reciprocals of these resistances are 0.124, 0.88 and .06 respectively.

Substituting these values for the former in the formulas previously given, we have:

FOR HARD-DRAWN COPPER WIRE, NO. 0.

	Ohms with full load.	Ohms with ¾ load.	Ohms with ½ load.
At C....	8.06	11.36	16.67
At D....	8.184	11.484	16.794
At B....	4.0617	5.744	8.361
At A....	2.7556	3.87	5.624

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*From the "Tramway and Railway World," London.

For "Phono-Electric" Wire, No. 0.

	Ohms with full load.	Ohms with ¾ load.	Ohms with ½ load.
At C....	8.06	11.36	16.67
At D....	8.36	11.66	16.97
At B....	4.105	5.754	8.41
At A....	2.849	3.9495	5.72

We have in this case increased the resistance of the trolley line 2.4 times with the following effects upon the working resistance.

When passing the feeding point there is of course no difference brought about by change in the resistance of the trolley line.

When passing D, that is when the full resistance of a working section is interposed between the source of current and the car, the increase of working resistance is only 2.15 per cent.

When we introduce another car and another full working section of trolley line, ahead of the last car and its full working section of trolley line, the increase of working resistance due to increased resistance of trolley line is, at B, 1.06 per cent. on full load.

When we introduce another or third car and its full working section of line ahead of the other two, the increase at A is 3.39 per cent. on full load.

For ¾ load the increments are respectively:

For D. 1.53 per cent.
For B. 0.17 per cent.
For A. 2.034 per cent.

And for half load:

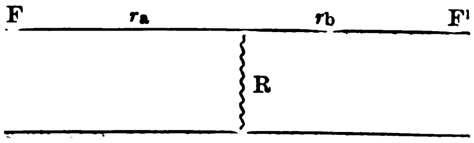
For D. 1.048 per cent.
For B. 0.59 per cent.
For A. 1.706 per cent.

Therefore, even under these extraordinary and extreme working conditions, the increase of working resistance is a negligible quantity, lost in the greater fluctuations of current due to ordinary differences of load, as may be seen by consulting the load diagram of any station.

The foregoing figures do not, however, convey how inappreciable in practice is the effect on the working resistance of an increased resistance of trolley wire, because they are based upon an exaggerated consideration of the working conditions, and such unfavorable conditions do not occur in rational practice in which feeders are employed.

With feeders the section of the trolley wire between the feeders is supplied with current at both ends, so that to a a car midway between the feeders each half of this wire is in parallel with the other half as a supply to the motor.

This is illustrated in the following diagram:



R will represent the car resistance, and r_a and r_b the two roads by which R is fed. The working resistance is given by:

$$\frac{1}{\frac{I}{r_a} + \frac{I}{r_b}} + R$$

r_a being in joint resistance with r_b.

Taking the same practical data as before, 0.124 ohm for the resistance of the trolley line between feeders, the working resistance for the full load of 62 amperes is:

$$\frac{1}{\frac{I}{.062} + \frac{I}{.062}} + 8.06 = 8.091 \text{ ohms.}$$

For ¾ load the working resistance is 11.391 ohms, and for half load it becomes 16.701 ohms.

Increasing the resistance to 0.3 ohm in the trolley line we have,

For full load, 8.135 ohms.
For ¾ load 11.435 ohms.
For ½ load 16.745 ohms.

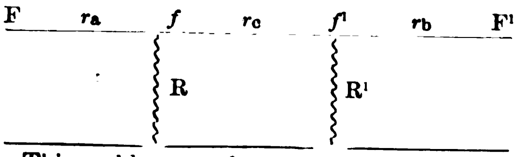
The increase of resistance of the trolley wire 2.4 times produces, under these practical conditions:

An increase of only 0.54 per cent. for full load,

An increase of only 0.38 per cent for ¾ load, and

An increase of only 0.26 per cent. for ½ load, in the working resistance.

Finally, let us consider the case of two cars between feeders:



This problem may be attacked in more than one way.

First, by assuming that $r_a = r_b$ and the conditions such that the potential difference at the ends of r_c is the same, so as to give no current in r_c, when the working resistance is:

$$\frac{1}{\frac{I}{R + r_a} + \frac{I}{R_1 + r_b}}.$$

Second. More generally, by considering the working resistance as composed of the joint resistance of F to f with F' to f', and the resistance at the point f or f'; the working resistance is then:

$$\frac{1}{\frac{I}{R} + \frac{I}{r_c + R_1}} + \frac{1}{\frac{I}{r_a} + \frac{I}{r_b}} \quad \text{(A).}$$

If we consider three cars between feeding points, the latter formula becomes:

$$\frac{1}{\frac{I}{R} + \frac{I}{r_c + \frac{I}{\frac{I}{R} + \frac{I}{r_d + R_2}}}} + \frac{1}{\frac{I}{r_a} + \frac{I}{r_b}}, \text{ and so on (B).}$$

Taking formula A, and a resistance of .124 ohm between feeders, we have:

For full load, 4.0625 ohms as working resistance.

For ¾ load, 5.7275 ohms as working resistance.

For ½ load, 8.3675 ohms as working resistance.

Increasing the resistance between feeders to 0.3 ohm, we have:

For full load 4.107 ohms as working resistance.

For ¾ load 5.755 ohms as working resistance.

For ½ load 8.411 ohms as working resistance.

Thus the percentage of increase in working resistance is:

For full load, 1.09 per cent.
For ¾ load, 0.74 per cent.
For ½ load, 0.52 per cent.

The preceding investigation is based on the consideration of any particular point on the line wire of the trolley system; consequently it does not fairly apply to the consideration of the system as a whole, and therefore not to the effect on the commercial economy of the entire system. In other words, we may desire to know generally what would be the increase in the coal bill due to increase of resistance of the trolley line.

This may be arrived at practically in this way. It is well known that on a trolley system worked at 500 volts, it may be generally taken that the total wattage divided by the working voltage as obtained from the records of the generating station, gives an amperage of 20 per car. If we take this amperage as evenly distributed (which on the doctrine of averages is a correct assumption) our equivalent resistance appears as $\frac{500}{20} = 25$ ohms. Setting our car midway in a feeder section, or under maximum effect, we have for a section resistance of .124 ohm.

$$\frac{1}{\frac{I}{.062} + \frac{I}{.062}} + 25 =$$

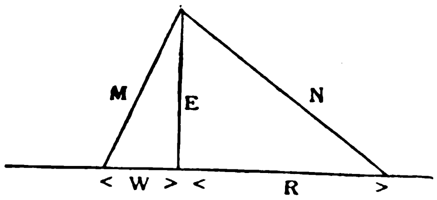
The working resistance = 25.031.

Increasing the section resistance to 0.3 ohm we have a working resistance of 25.07495, or an increase of 0.175 per cent. as the mean increase of working resistance—of course a practical infinitesimal quantity.

The figures arrived at have been deducted by a process rendered tedious by the nature of the parallel-arc circuits involved, but they show that the idea of an increased resistance of the trolley line (by several hundred per cent. even) producing any appreciable effect on the general working economy is chimerical, and a first-class bug-bear.

Realizing that your inquiry is made with a view to ascertain the effect of substituting "Phono Electric" wire for hard-drawn copper wire for the trolley lines, I have to say expressly that the consideration of the higher specific resistance, or lower conductivity of "Phono-Electric" wire has no practical bearing on the general working resistance of the trolley system. On the contrary, from investigation I have found that the higher resistance is not only negligible, but completely disappears in the better contact afforded by the inoxidizable surface of "Phono-Electric" wire, and, by its freedom from arcing with the trolley wheel. Also that the immensely superior tensile strength of "Phono Electric" wire allows of it being hung with less sag and with greater resilience and firmness in its contact with the trolley wheel, thereby considerably reducing the actual working resistance, and because "Phono-Electric" wire does not anneal or soften under the action of excessive electric currents, these favorable conditions are constantly maintained—a matter of the greatest importance in the cases of a "burn-out," or where a large number of cars have become stalled on a given section and may be started with small headway.

Engineers at the present day so wisely prefer a diagrammatic representation of results, that I am induced to extend this somewhat tedious investigation to include a diagram showing how very small is the increased work at a glance. The diagram appended is thus constructed:



If on a line representing a conductor of resistance R, we raise a vertical representing the impressed electromotive force E, we can by obvious geometric construction represent the work done at the point where the vertical is raised.

For $\frac{E}{R}$ gives C, the current; and EC = work = W.

But $EC = E\frac{E}{R} = \frac{E^2}{R} = W$; the equation $W = \frac{E^2}{R}$ being of the order of ratios W : E : : E : R. The vertical E can be described geometrically as a mean proportional (and M being drawn at right angles to N) so that as is obvious from inspection of the diagram, W represents the work, in watts, if E and R be plotted in volts and ohms respectively.

If in such a plotted diagram 100 volts are plotted to the inch, and only one ohm to the inch, the differences of work are shown one hundred fold greater than to true scale, or are multiplied one hundred times, which should be borne in mind in consulting the diagram, the differences on the work line being actually one hundredth of those shown. Such a diagram immediately conveys to the eye the complete unimportance of the true differences.

HOW TO BECOME A FOUNDRY FOREMAN.*

BY A. FRANKENHEIM.

To become a successful foundry foreman requires a knowledge of metallurgy and cupola practice. One must understand the different branches of moulding thoroughly, consisting of green sand, dry sand, and loam work, and, above all, the method of handling men, so that their services will be profitable to their employer.

I have come in contact with foremen who were not very good moulders, but they understood the theory of the trade thoroughly. There were far better moulders in the same shop, but these foremen could impart their theoretical knowledge, and in turn give the others a point or two. They could also handle their men to the best advantage, and as they understood the theory of cupola practice, they were quite at home when it came to taking off a heat.

One of these foremen was a very young man, having served his time at patternmaking. While working at that trade he would occasionally take a stroll through the foundry and see what was going on, always keeping his eyes and ears open. When any large work was being done, he would make sketches and discuss the easiest way to mould it with those working on the job. This young man soon became liked by the moulders, and even by the foreman, for in all his discussions, he always spoke intelligently, and his sound opinion was admired by all. I often heard him say that he would become a foundry foreman, and he did.

It is plain that this young man could not have reached such a high standing among his fellow-shopmates if it had not been for study. He would purchase books on metallurgy, moulding, and cupola practice, and after his day's work in the pattern shop, he would study at night and in the cars, as he went to and from the shop, never neglecting his work in the shop.

At present there is a great fault among the majority of moulders in that they will not study the theory of their trade. Somehow I cannot account for it; it is either that they are played out by their day's work, or they are perfectly satisfied with their positions and have no desire to advance.

Even apprentices in the foundry do not seem to care to study, and it is too bad for a young man to thus let his mind grow dull. It is very wrong for a foreman to put an apprentice on too hard work, for it draws the ambition clear out of him, and consequently his future is ruined, if he does not take to study, for this occupies his mind and tends to develop it.

I say for the benefit of apprentices and moulders that they should read scientific books pertaining to their trade. They may be borrowed from most public circulating libraries. But in small towns where they cannot procure such books, they either have to suffer the consequences of doing without them, or they have to purchase them, thus involving considerable expense, though it is money well spent.

In some large cities it is difficult to locate a library having them. Some time ago I inquired at a few of the public circulating libraries why they did not have such books, and the librarian told me that the majority of the population were not interested in such works, and that was the reason they did not have them on hand. I would recommend that large works and foundries purchase a complete set of such books, and issue them to the men in their employ. It will certainly be of great benefit to the moulders as well as to their employers.

On the other hand, as regards the education of moulders, I have come in contact with some very intelligent men. They have certainly devoted their spare time to study, and have learned mechanical drawing. This subject is very important to a moulder if he wants to better his position. I do not recommend it for the simple sand pounder, who feels content if he has put up 60 or 70 boxes of sash weights for a day's work, and then goes home with a trowel sticking out of his pocket, and thinks he has mastered the art of moulding. Oh no it is not for him; it is for those men who strive to get ahead; it is for those who possess ingenuity, integrity, self-reliance, and ambition.

For example, there is a large cylinder to be moulded in loam. It is very often the case that the drawing will be shown to the foreman or the moulder on the job. It will fairly rattle these people, if they do not understand it, being, as it is, just like Latin or Greek to them; and they would have made better headway on the job if they had never been shown the drawing. On the other hand, if a man who understands drawing worked on the job, he would read it fluently and have his sweep and steam chest set, and would know where every core belonged, while the other fellow would be fussing, tinkering, or trying to find out what it all meant.

It will readily be seen that the foreman will like the men who can do a job without bothering him, and so keeping him from devoting his time to the rest of the men in the shop. Mechanical drawing means business, and the moulders who understand it can command higher wages and act as foundry foremen.

In order to gain the goodwill of the men under them, foremen should treat all equally. Do not be too familiar with the men under you; be sharp, firm, and persistent, and show them that you are running the shop and you will always be respected. Do not have any favorites, for this makes the men discontented and excites a good deal of comment.

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* From the "Foundry."

Electro-Therapeutic Association Officers.

At the recent meeting of the American Electro-Therapeutic Association, held at Buffalo, N. Y., the following officers were elected: President, Dr. Frederic H. Morse, Melrose, N. Y.; first vice-president, Dr. D. R. Brower, Chicago, Ill.; second vice-president, Dr. Alfred T. Livingston, Jamestown, N. Y.; treasurer, Dr. R. J. Nunn, Savannah, Ga.; secretary, Dr. Geo. E. Bill, Harrisburg, Pa.; executive council, Dr. Robert Newman, New York City; Dr. Ernest Wende, Buffalo N. Y.; Dr. William H. White, Boston, Mass.; Dr. Frederic Schavoir, Stamford, Conn.; Dr. F. B. Bishop, Washington, D. C.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended October 2:

Aden, 1 package, $81; Antwerp, 28 packages, $2,105; Argentine Republic, 70 packages, $3,986; Australia, 10 packages, $154; Berlin, 1 case, $560; Bradford, 35 packages copper wire, $270; 1 case, $145; Brazil, 106 cases, $9,318; Bremen, 4 cases, $494; British Possessions in Africa, 227 packages, $19,515; Bristol, 16 cases, $2,500, British East Indies, 59 packages, $2,666; British Guiana, 43 packages, $746; British West Indies, 21 cases, $623; Cardiff, 1 case, $80; Central America, 17 cases, $549; Chili, 1 case, $52; Copenhagen, 3 cases, $87; Cuba, 604 cases, $2,128; Dutch West Indies, 5 packages, $111; Genoa, 2 packages, $467; Glasgow, 34 cases, $2,416; 8 packages, $322; Hamburg, 1 case, $35; 55 packages, $6,738; Havre, 28 cases, $2,629; Japan, 306 cases, $40,257; Korea, 8 cases, $145; Leeds, 1 case. $85; Lisbon, 8 packages, $995; Liverpool, 323 packages, $13,670; London, 328 packages, $24 204; Manchester, 44 packages, $2,766; Marseilles, 2 cases, $260; Mexico, 237 cases, $20,257; Milan, 1 case, $50; Newcastle, 4 cases, $200; New Zealand, 7 packages, $105; Paraguay, 68 cases, $687; Peru, 28 cases, $682; Philippines, 65 cases, $1,208; Riga, 8 cases, $1,150; Santo Domingo, 2 packages, $41; Siam, 28 cases, $1,400; Southampton, 45 packages, $5,289; St. Petersburg, 4 cases, $200; U. S. Colombia, 2 cases, $41; Venezuela, 52 cases, $702; Zurich, 1 case, $57.

PERSONAL MENTION.

Mr. John Neville, inventor of the International cable and telegraphic code, in use in all parts of the world, was killed by a freight train, six miles south of Elmira, N. Y., on October 1.

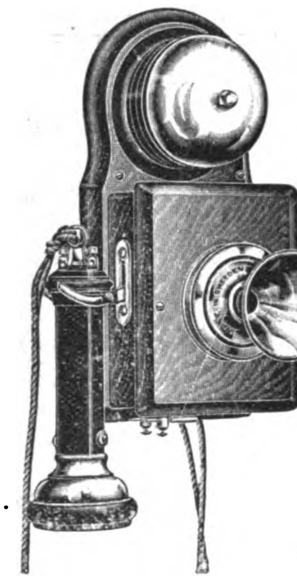
Mr. Russell W. Hargrave, one of the superintendents of the Northern Electric Company of Madison, Wis., formerly an instructor in engineering in the State University, has accepted the superintendency of the mechanical and electrical department of the silk factory which George Alexander Dowie has established at Zion, Wis.

Mr. F. L. Dane has been appointed assistant manager of the Union Electric Company of Dubuque, Ia.

Mr. J. Lee Judson, one of the prominent financiers and business men of Rochester, N. Y., died on Saturday, October 4, after four days' illness. He was president of the Rochester Gas & Electric Company.

TELEPHONE SYSTEMS IN PRIVATE HOUSES.

The private house of to-day instead of being equipped with a speaking tube, as was the custom a few years ago, generally has a modern telephone system connecting the various departments with each other. The main advantage of the telephone over the speaking tube is that one outlet or one 'phone can be used to communicate to all of the different stations, whereas when the speaking tube was used a separate mouthpiece was needed for each and every station. In locating these outlets for the telephone great care should be taken in placing them where they will be most convenient for the use of the household and also where they will not interfere with any of the fittings of the house which are to be installed at a later date, such as radiators, sideboards, etc. A very convenient place is near the casing of the door, as it is almost impossible to place any heavy article of furniture near the door. Caution should be used in first discovering which way the door is to swing.



The wire cable which is used in connecting the various stations should run as far from the water pipes as possible, on account of breaks in the pipes which are liable to occur, and the moisture from which would injure the wires, make cross-connection, cause leaks of current and soon destroy the vitality of the battery. A cable having a weatherproof insulation is preferable, not only on account of the properties which prevent moisture from entering the same, but also because a cable of this kind is not attacked by rats or mice. These animals gnaw the insulation, and while they do not injure the wires, in the ordinary cable, they frequently cause crossing or grounding of wires, which is difficult to locate and is very annoying both to the owner and the electrician.

Wall pockets or receptacles for holding the telephone are very useful at the outlets, for while keeping the telephones fully covered they do not deface the walls, and by their use many of the connections can be made inside and a buzzer or a bell can be placed within for the purpose of calling that station. The telephone itself can be very small and compact and by using the hand microtelephone in connection with a selective switch (see cut) an instrument having a capacity of fifteen stations will occupy a space of only four or five inches square.

Woodwork in special design and finish is often used to match the finish of the room, and thus the telephone can be made an ornament as well as a great convenience. In some mansions the wooden cases have been made of solid ebony, rosewood or other costly woods, while the metal parts have been gold plated.

There is no limit to the flexibility of a system of this description, as any station can call all the departments or it can be so wired as to call only a certain few. Arrangements should be made for bringing the cable to a point where it can be attached to wires going to the stable, greenhouse, etc., these connections being especially convenient for the lady of the house, as in ordering the carriage for a drive, etc.

By a simple attachment in the owner's chamber, the telephone system can be instantly converted into an alarm system and all the bells be made to ring at one time by the simple pressure of a special lever. This can be used in case of fire, burglars or sickness, and is very valuable in suburban residences.

As to the construction, the cable itself should be installed while the house is in process of construction and should be put in place before the studding is covered with lath and plaster. The instruments themselves should not be placed on the wall until all the workmen have left the building for good, as telephones are apt to be regarded as an object of curiosity by workmen doing other work and oftentimes considerable damage is done by their carelessness.

We show two simple instruments which are well adapted for household purposes and are reasonable in cost. These and other patterns can be obtained from the Ericsson Telephone Company, 296 Broadway, New York City, who sell their telephones outright and subject to no rental or other charges. Their telephones are durable and can be relied upon as sure to give satisfaction. Numbering among their customers many well known people, they aim to suit the requirements fully and in every case to please their patrons. We predict that the use of telephones in all the finer residences and apartments is only a question of time, and once used people will insist on having them, because they are so convenient and save so much time.

INCORPORATIONS.

The Watern River Electrical Company, St. Paul, Minn. Capital stock $200,000.

The Cincinnati Electric Motor Company, Cincinnati, O. Capital stock $50,000.

The Turner Motor Company, Trenton, N. J. Capital stock $500,000. Incorporators: Robert J. Turner, John E. Palmer, and John L. Ritchie, Newark.

The Winters Electrical Company, Toledo, O. Capital stock $5,000. Incorporators: R. H. Winters, Ralph S. Holbrook, W. L. Holbrook, George A. Bassett and L. H. Payne.

The Electrical Investment Company of Indiana, Ft. Wayne, Ind Capital stock $100,000. Directors: Louis Fox, Isabel S. Coverdale, Gottleib Haller, Charles H. Worden, Edward F. Yarnelle, William E. Mosman, Charles A. Wilding, Oliver S. Hanna, Melville A. Mason, Samuel M. Foster, Ernest W. Cook, William J. Vesey, Owen N. Heaton, Charles F. Pfeiffer, George W. Beers and Theodore Howard.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCT. 1, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

683,534. Trolley. Edwin A. Wakefield, Pelham, Mass. Filed May 31, 1901.

683,663. Device for Taking Off Current for Electric Tramways. August Reinecke, Neviges, Germany. Filed April 12, 1901.

683,681. Railway Signaling. William G. Roome, Jersey City, N. J. Filed Feb. 25, 1901.

683,719. Car-Fender. Edmund Amrein, St. Louis, Mo., assignor of one-half to David J. Signaigo, same place. Filed Dec. 3, 1900.

683,772. Trolley-Wheel. Daniel E. Kempster, Boston, Mass. Filed April 1, 1901.

683,783. Crossing-Signal for Railways. Frank McBrien, Newark, N. J., assignor to the Union Switch & Signal Company, Swissvale, Pa. Filed April 19, 1901.

683,843. Railway Signal. Frank E. Button, New York City. Filed Aug. 9, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

683,432. Apparatus for Lighting Vehicles by Electricity. Benny Bernstein, New York City, assignor of one-fourth to Benno Loewy, same place. Filed Nov. 28, 1900.

683,558. Manufacture and Repair of Incandescent Electric Lamps. Ferdinand Fanta, London, Eng. Filed May 26, 1900.

683,767. Incandescent-Lamp Burner. Hermann Hurwitz and Aisik Schapiro, Berlin, Germany. Filed June 22, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

683,444. Circuit-Controller. William W. Cowen, New York City. Filed Jan. 8, 1901.

683,601. Electric Brake. Edward A. Henry, Crestline, Kan. Filed Sept. 17, 1900.

683,709. Controller for Electrical Apparatus. George W. Schilling, Philadelphia, Pa. Filed May 16, 1901.

683,831. Electric Meter. Vittorio Arcioni, Spoleto, Italy, assignor to Camillo Olivetti, Ivrea, Italy. Filed June 5, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

683,480. Supervisory Signal for Telephone Switchboards. Frank R. McBerty, Evanston, and James L. McQuarrie, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Filed Aug. 19, 1898.

683,505. Telephone-Circuit. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 20, 1900.

683,569. Automatic Signaling System for Telephone-Exchanges. James L. McQuarrie, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 26, 1901.

683,631. Telephone-Receiver. Hubert L. White, Utica, N. Y. Filed March 22, 1900.

MISCELLANEOUS.

683,451. Electromagnet. Edward B. Ellicott, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 26, 1900.

683,460. System of Distribution. William S. Gould, New York City, assignor to Gould Storage Battery Company, same place. Filed Jan. 31, 1901.

683,494. Battery-Plate Separator. Henry C. Porter, Chicago, Ill., assignor of one-half to the Owen H. Fay Livery Company, same place. Filed Feb. 5, 1900.

683,521. Anchor for Pipes of Conduits in Electrical or other Systems. Louis Teuscher, Laporte, Ind. Filed May 16, 1901.

683,564. Electric Appliance for Treatment of Defective Hearing. William H. Loop, Cohoes, N. Y. Filed Sept. 29, 1900.

683,615. Method of Duplicating Phonographic Records. Walter H. Miller, Orange, and Jonas W. Aylsworth, East Orange, N. J., assignors to National Phonograph Company, Orange, N. J. Filed July 31, 1900.

683,616. Electrical Automatic Safety Hand Contact Firing-Key. Thomas J. Moriarty, Newport, R. I., assignor of one-half to John T. Reagan, same place. Filed Jan. 17, 1901.

683,622. Electrical Measuring Instrument. Harry O. Rugh, Sandwich, Ill. Filed July 24, 1901.

683,657. Electric Burglar Alarm. Alfred J. Noreen, Chicago, Ill. Filed March 9, 1901.

683,659. Apparatus for Heating and Agitating Air. Edwin F. Porter, Boston, Mass., assignor to the Bay State Electric Heat and Light Company, Jersey City, N. J. Filed Feb. 17, 1898.

683,668. Electrical Measuring Instrument. Nathan H. Suren, Needham, Mass., assignor to Gamewell Fire Alarm Telegraph Company, New York City. Filed Feb. 16, 1901.

683,676. Apparatus for Duplicating Phonographic Records. Jonas W. Aylsworth, East Orange, and Walter. H. Miller, Orange, N. J., assignors to National Phonograph Company, Orange, N. J Filed July 31, 1900.

683,680. Electromassage Device. Lee J. Chapman, Columbus, O., assignor of one-half to Denman Kinsell, Jr., same place Filed July 31, 1901.

683,689. Electric Operation of Elevators. John D. Ihlder, Yonkers, N. Y., assignor to Otis Elevator Company, East Orange N. J. Filed April 26, 1901.

683,712. Carriage Traveling Gear for Phonograph-Machines. Thomas H. Stevens, East St. Kilda, Victoria. Filed Mar. 23, 1901.

683,759. Electric Signaling Apparatus. Felix B. Herzog and Schuyler S. Wheeler, New York City, said Wheeler assignor to said Herzog. Filed Jan. 29, 1886.

683,860. Muffler for Automobiles. Samuel D. Mott, Passaic, N. J., assignor, by mesne assignments, to Motormobile Company, Jersey City, N. J. Filed Dec. 4, 1900.

683,872. Electrical Signaling Apparatus. Alfred U. Alcock, London, Eng. Filed Jan. 31, 1901.

THE TELEPHONE WORLD.

Pennsylvania Companies Consolidate.

A consolidation of all the independent telephone companies of Easton, Pa., which is to be a formidable rival of the Bell system, was effected in Allentown October 1, and is to be followed by the merging of all the independent systems of the entire State of Pennsylvania with those of New Jersey, and eventually to connect with a proposed system between New York and Boston. The corporate title of the combine is the Consolidated Telephone Company of Pennsylvania and the principal offices are to be in Allentown. The officers are: President, Robert E. Wright, Allentown; secretary, Dr. T. H. Leidy, Reading; treasurer, C. M. W. Keck, Allentown. The board of directors has not been chosen.

The telephone companies consolidated are as follows: People's Telephone Company of Wilkes-Barre, covering towns in Luzerne County; the Anthracite Telephone Company of Hazleton, covering Hazleton and towns in Luzerne and Carbon Counties; the Slate Belt Telephone Company, Slatington, and the surrounding slate regions of Lehigh and Northampton; the Lehigh Telephone Company of Allentown, Catasauqua and towns in Lehigh County; the Schuylkill Valley Telephone Company, whose plant is now being reconstructed, and covers towns in Bucks, Schuylkill and the City of Reading; the Lackawanna Telephone & Telegraph Lines of Scranton; the Inter-State Telephone & Telegraph Company, which begins at Scranton and extends through Pittston, Carbondale, Wilkes-Barre, Hazleton, Lehighton, Mauch Chunk, Slatington, Allentown, Norristown, and at Philadelphia connects with the Keystone Telephone Company, now erecting its plant in Philadelphia. It also has a branch line from Norristown to Trenton, where it connects with the independent lines in New Jersey and New York.

The paid up capital of the company is $4,000,000. The present issue of bonds is $2,500,000, and it has in the hands of the mortgage trustees $3,500,000 of bonds, to be issued for the purchase of additional plants, and the extension of the system. The company is also negotiating for several other plants.

General Superintendent Farnsworth, of the Northern Texas division of the Erie Telegraph & Telephone Company, has been in Boston, Mass., lately in conference with prominent officials of the company. He reports the telephone situation in Texas as much improved; says that the opposition has, as yet, made little headway in that section; that the physical condition of the company's property is being well maintained, even though new construction work has been kept down somewhat. Further extensive improvements on the plant at Forth Worth and at several other points are now being planned. The results for the year, as a whole promise to be most satisfactory. From another source it is learned that an early reorganization of the operating departments of the Southwestern and other companies controlled by the Erie people will be effected.

The Waverly, Ia., telephone system has finished laying about 1,500 feet of underground circuit. New switchboards are being put in which will accommodate about 400 patrons, and other improvements are being made. All work will be completed in a short time. The telephone exchange there, now known as the Waverly Telephone System, was, until recently, operated by the Cedar Valley Telephone Company, which sold the exchange to a local company organized in Waverly. Half the stock in the new organization is taken by the Cedar Valley Telephone Company, the rest by citizens of Waverly. The capital of the new company is $30,000.

The Sunset Telephone & Telegraph Company of Tacoma, Wash., announces that all arrangements have been perfected for the transferring of certain wires to its underground system, and the general straightening out of the lines to fit the new condition of affairs incidental to the recent removal to the new telephone building.

The New Home Telephone Company, which owns the franchise and privileges of the old Home Standard Telephone Company, is hurrying work on the installation of its service in Albany, N. Y., and it will not be long before that city has two rival companies operating at the same time.

Mr. Moss recently introduced an ordinance granting to the Telephone Company of America a privilege to construct, maintain and operate a system in New Orleans, La., for a period of 25 years.

Increase of 28,848 instruments in the net output of the American Telephone & Telegraph Company for the month ended September 20, makes a net increase of 136,801 instruments since December 20, 1900.

Combine of Independent Companies.

All the independent telephone companies of Central West Virginia have combined and will be known as the Central West Virginia Telephone Exchange. Officers have been elected as follows: H. C. Henderson, Parkersburg, president; P. W. Lowe, Mannington, first vice-president; Hugh Amos, Burnsville, second vice-president; J. K. Monroe, Kingwood, third vice-president; J. I. Alexander, Clarksburg, secretary and treasurer.

Rates will be adjusted and many matters given attention that will tend to improve the service in the territory covered.

At a meeting of the telephone managers at Manhattan, Kan., a short time ago, it was decided that work on the new independent telephone toll line to Kansas City will begin as soon as possible. The company will be incorporated for $100,000, paid up capital. The new company expects to put up enough copper wire to handle the business out of Kansas City with ease. Ten wires will be put up between Kansas City and Topeka, six between Topeka and Junction City and from between Junction City and Salina. The promoters expect to enter Kansas City, Kan., by January 1, but the time of entering Kansas City Mo., will depend upon how soon a franchise is granted for an independent company. The line will be a trunk line and will only break in on county seat towns.

Recent news from Salt Lake City, Utah, states that a contract has been entered into between the Rocky Mountain Bell Telephone Company and the Mammoth Mining Company for the proper equipment of the telephone line between Robinson and Cherry Creek, which is owned by the Mammoth Company. The line is 18 miles long and runs to the Mammoth Company's water plant, which supplies a number of the big Tintic mines. The telephone company proposes to put in long-distance 'phones on the line which has been used by the ranchers and others around Cherry Creek. The Mammoth Company is to have free use of the line and receive 25 per cent. of the profits.

Uniontown, Ala., in to have a telephone system. Poles are being placed now, and as soon as possible wires will be strung and instruments installed. The system will be connected with the Bell Telephone long-distance wire, so that subscribers will be virtually connected with the leading cities throughout the country.

A force of men recently arrived in Watkins, N. Y., to commence the construction of the new telephone line which is to be built by the Watkins Telephone Company. It was originally the new Century Telephone Company of Cleveland. It has secured over 300 subscribers in that village and promises to give the best of service.

The Saratoga, N. Y., Telegraph & Telephone Company directors met in Ballston Spa last week, and let the contract to the Eastern Construction Company of Philadelphia for the construction of the line connecting Saratoga, Ballston, Mechanicville, Waterford, Schuylerville and Greenwich.

The Home Telephone Company, organized with a capital stock of $40,000 by Jerome Herff, has awarded the contrct for the construction of its system in Peru, Ind., to the Jones & Winters Construction Company of Chicago, and the line is to be ready for use by January 1, 1902.

We are informed that the Home Telephone Company, Jamestown, N. Y., is about to put in a 1,500-line telephone exchange, and is in the market for the entire equipment of instruments and lines; the lines will include several miles of underground construction.

The Eureka, S. D., Telephone Company has purchased the Eureka & Mound City Telephone System, and will at once extend its lines to Ashley and all the new towns on the Soo line.

A new telephone system has been put in operation between Calvert and Maysfield, Tex. The line is private property, but will prove of great convenience to citizens in both places.

The North American Telephone Company purposes to build a line from Texas through Indian Territory and Oklahoma to Kansas City and St. Louis.

T. R. Bennett, L. A. Bush, M. E Bush and F. L. Lewis have applied for incorporation of the Camilla, Ga., Telephone Company, and a franchise has been secured.

The New England Telephone Company is making arrangements to put in a new switchboard at the Keene, N. H., exchange, and add a chief operator to supervise the service.

Lower Telephone Tariffs.

The American Telephone & Telegraph Company has changed its tariffs all over the United States, so that one can now use the telephone for a three-minute period as the minimum, instead of a five-minute minimum, as formerly, and has made the charge for the three minute period about three-fifths that of the five-minute period. The three-minute charge between New York and Boston is $1.25 for day time, and 65 cents for night, in place of $2 for $1 respectively for the five-minute period.

According to a report to the State Department from Consul General King at Bankok, Siam, few cities are better fitted to appreciate a first-class telephone system than Bankok, as the palace and its surrounding buildings are quite widely separated from the legations and consulates, the walled city from the residences of most of the foreigners, the large foreign firms one from the other and in fact the entire old city from the new. "The Siamese," says Mr. King, "are a people who know a good thing when they see it, and they, together with the long suffering members of the foreign community, would generously patronize a good telephone system were it once established." There are 200 instruments, he says, in a city where there should be 1,000, and these decidedly better instruments.

The Interurban Telephone Company of Madison, Wis., has filed articles of association with the Secretary of State, its purpose being to construct, operate and maintain a system of telephone lines and exchanges in Wisconsin, and which may be extended outside the State. The capital stock is $200,000 and the incorporators are A. L Hutchinson, H. E. Kepler and Charles Schernecker.

An effort is being made to establish a telephone exchange at Cortland, Ala. Many of the large planters live in town and have no means of communication with their plantations. This, with the business houses, would furnish a sufficient number of subscribers. If the system is established it will have connection with the long distance telephone.

The Missouri & Kansas Telephone Company of Leavenworth, Kan., has notified the 300 business houses in the city, who use its 'phones, that the rental of the 'phones hereafter will be $3 per month, which is a raise of $1. The raise will not affect the residence 'phones.

A report from Trenton, N. J., states that the plant of the Home Telephone Company is to be sold under foreclosure of the mortgage bonds, which are held by the Interstate Telephone Company. The sale will take place at the sheriff's office on Wednesday, October 30, at 2 P. M.

At a late meeting of the directors of the Twin City Telephone Company of St. Paul, Minn., it was voted to increase the number of directors from five to seven, and John D. Beatty, of Philadelphia, and Second Vice-President Buck were the new directors elected.

The Peninsular Telephone Company is erecting poles, and says it is to stay in Bartow, Fla. So the people there may have some exciting times in the telephone business before long.

An independent telephone company, with headquarters at Waco, Tex., has made application to the city of Marshall for the privilege of running its line there.

Amended articles of the Jessamine, Ky., Home Telephone Company have been filed, increasing the capital from $10,000 to $20,000.

Sixty new telephones have been installed at Eugene, Ore., in the last few days.

A telephone line is being constructed from Hitchcock to Galveston, Tex.

TELEPHONE INCORPORATIONS.

The Cass County Telephone Company, Logansport, Ind. Capital stock, $50,000.

The De Soto Telephone Company, De Soto, Kan. Capital stock, $500.

The Jackson County Telephone Company, Indianapolis, Ind. Capital stock, $5,000.

The Logansport Home Telephone Company, Logansport, Ind. Capital stock, $150,000.

The Rushylvania Telephone Company, Rushylvania, O. Capital stock, $2,500. Incorporators: J. Ferguson and others.

The Cambria County Telephone Company, Cresson township, Cambria County, Pa. Capital stock, $50,000.

GENERAL ELECTRICAL NEWS.

Lighting.

Conneaut, O.—Bids will be received until October 21 for the purchase of $20,000 4 per cent. 20 years electric light bonds. J. Simons, clerk of finance committee, can be addressed for further information in relation to same.

De Smet, S. D.—S. E. Brookman contemplates putting in an electric light plant for lighting the town.

Dickson, Tenn.—A public meeting will be held to decide on issuing $35,000 for a water and light plant.

Greensboro, N. C.—The Gate City Furniture Manufacturing Company will install an electric light plant.

Holley, N. Y.—The village board has contracted to buy the Bradford property owned by John Murphy in this village and will use the same for a site for the new electric light plant. Architect J. Mills Platt of Rochester will draw plans and specifications for the plant, and as soon as his plans are completed and accepted the board will advertise for bids to construct the buildings.

Ipswich, Mass.—This town has voted to establish a plant for electric lights.

Jasper, Ala.—Hon. T. L. Long, a leading business man of this place, gives out the statement that a man with ample means has made a proposition to him that if the city of Jasper will grant a franchise, he will put in a first-class waterworks and electric light plant here.

Lenmoore, Cal.—The question of issuing $22,000 light and water bonds will be decided October 21.

Lewistown, Pa.—A charter was recently granted to the Granville Electric Light Company of this place, capitalized at $1,000.

Nashville, Tenn.—The permit for the erection of the new electric light plant by the city was lately issued to Building Commissioner R. W. Miller. The cost will be $25,000.

Pittston, Pa.—Philip Raub is considering the advisability of installing an electric light plant at his Dallas hotel.

Readsboro, Vt.—The citizens are considering the matter of installing an electric lighting plant.

Reedsville, Pa.—The Reedsville Electric Light Company has been chartered here with a capital of $1,000.

Rochelle, Ill.—The council is discussing whether to sell the city's electric plant or make necessary repairs, purchase machinery and operate it.

Southampton, N. Y.—A new electric light company is to be formed here to be known as the Suffolk Light, Heat & Power Company. The capital stock of the company will be $25,000, and the formation of the company is assured as the stock has been more than $12,000 oversubscribed.

St. Cloud, Minn.—E. G. Holmes has sold his interest in the Detroit electric lighting plant to J. H. Smith and William Long.

St. Louis, Mo.—The Citizens' Electric Light & Power Company, of which Julius S. Walsh is president, is preparing to build its proposed electric lighting and power plant. The company organized several years ago with $3,000,000 capital stock. Chas. H. Ledlie, is general manager and engineer.

Telluride, Col.—The city council has granted a franchise for 15 years to the Telluride Electric Light and Power Company.

Union, Ore.—The power house and dynamos of the Union Electric Light Company, located just west of this town, were totally destroyed by fire a short time ago.

Vassar, Mich.—The common council of this village has purchased the entire electric light plant from Balbion Brothers, and hereafter all electric lights will be controlled by the village council.

Weatherford, Tex.—An ice and electric light company was organized here recently to be known as the Crystal Ice Company, with C. C. Barthold as president and G. M. Bowie, John H. Prince, J. A. Rentz and C. W. McGee as directors.

Weiser, Idaho.—The city council has granted a waterworks and electric light franchise to William Pollman of Baker City.

Wharton, Tex.—It is rumored that Capt. Wm. Payson has asked for an electric light and waterworks franchise.

Street Railways.

Ballston Spa, N. Y.—The contractors have recently been making preparations to build the electric railroad from this village to Mechanicville.

Baltimore, Md.—It is announced that the United Railways & Electric Company will probably construct a trolley line in the northeastern section of the city upon several streets. George R. Webb is president of the company.

Bartow, Fla.—Judge C. A. Boswell and Baltimore parties are interested in the electric road soon to be built from here to the various phosphate mines in Polk County. He thinks that the road will be built at an early day.

Beach Haven, Pa.—The Columbia & Montour Electric Railway Company has been granted the right of way through this place.

Canton, O.—The Canton, Lodi & Medina Electric Company is the latest railway to be projected for this section of the country. The line is to connect Medina, Lodi and Canton, passing through a number of good towns on the way. The men back of the scheme are: W. W. R. Irwin, Wm. Wagner, John J. Whitacer, Edward Langenbach, Wm. J. Poyser, A. E. Townsend, John E. Monnot, John R. Reed, John C. Harmony and Augustus Dannamiller.

Frederick, Md.—It is expected that the Cumberland, Eckhart & Frostburg Electric Railway will be in operation December 1.

Fresno, Cal.—The Fresno City Railway Company has been incorporated with an authorized capital stock of $500,000. It will construct an electric street railway system 43 miles long.

Greenfield, Mass.—The preliminary steps for the building of an electric road to connect this place, Bernardston and Northfield, are being taken.

Jamestown, N. Y.—A trolley line is promised between Buffalo and this place within a year.

Las Vegas, N. M.—The Las Vegas Hot Springs Electric Railway Company has notified territorial secretary J. W. Reynolds that it has amended its by-laws increasing its capital from $200,000 to $350,000 for an addition to its original plan of building an electric railway from here to Las Vegas Hot Springs. V. O. Saunders and H. J. Reilly of St. Louis are completing arrangements to build the line.

Ossining, N. Y.—The Westchester Traction Company was incorporated last week with a capital stock of $200,000 to operate a street surface electric road from here to Pleasantville, Westchester County, a distance of five miles. The directors are Thomas F. Barrett, Harry M. Shaw, H. C. Willes, C. J. Harrington, D. E. Shaw and P. C. Ackerman of New York City, and R. E. Farley, G. N. Bissell and J. M. Farley of White Plains.

Poughkeepsie, N. Y.—The Citizens' Street Railroad and the Carroll Electric of Fishkill-Matteawan have consolidated, and both will hereafter be under one management. At least $20,000 will be expended to increase the capacity and efficiency of the electric works.

Preston, Minn.—A gigantic scheme is now in process of completion here for the construction of an electric railway from Decorah, Ia., overland to Chatfield, Minn. It is said that Hon. H. E. Wells of this place is one of the prime movers of the enterprise.

Richfield, Springs, N. Y.—A party of the capitalists who are interested in the trolley which is to connect Oneonta and Richfield by way of Cooperstown, were here a short time ago, to plan to secure the right-of-way on the latter end of the line.

Rochester, N. Y.—Plans are under way which, if they materialize, will result in a direct electric line connection between this city and Corning. The promoters of the proposed line have not yet fully made up their plans, but two of them, C. W. Granis of Syracuse, who is backed by a large amount of capital, and Robert O. Hay a well-known Corning civil engineer, are authority for the statement that the project will materialize into a reality.

South Haven, Mich.—The Grand Rapids, Kalamazoo & South Haven Traction Company is said to have secured capital for building an electric road from Grand Rapids to South Haven, 104 miles.

Toledo, O.—An electric railroad, 680 miles long, connecting this city with St. Louis and Chicago, is in prospect; 165 miles are in course of construction, and it is stated by those who should be in a position to know that the system will be in operation within the next 18 months.

Manufacturing.

East Orange, N. J.—The P. T. Motor Company had articles of incorporation recorded recently. Its object, as stated in the papers, is to acquire, manufacture and construct boats and vehicles for carrying passengers and freight, and to deal in electric, compressed air, oil and gas motors. The capital stock is fixed at $100,000. Albert R. Palmer, Edward T. Magoffen and John Reginald Turner are the shareholders. The principal offices in this State will be at 525 Main street, East Orange, where the New Jersey Registration & Trust Company will act as agent.

Company Matters.

Hamburg, S. C.—The North Augusta Development Company of this place has disbanded, and all rights, franchises, etc.. of the company have been regularly transferred to the recently chartered North Augusta Electric & Improvement Company.

Paducah, Ky.—The Paducah Gas & Electric Company, capitalized at $125,000, is successor to the Paducah Gas Company.

Portland, Ore.—Articles of incorporation of the Welsh-Newell Electric Company have been filed with the county clerk to show that the name had been changed to the Pacific Electrical Company.

Warren, O.—The Economy Electric Company, at a recent meeting of its directors, decided to enlarge its plant by building an addition 30 x 80 three stories high.

Power and Transmission.

Massena, N. Y.—The plant of the St. Lawrence Power Company at this place has started up. The company was capitalized at $6,000,000, and already $5,000,000 has been expended on construction. The plant has a capacity of 75,000 hp., and is said to be the largest power producer in this country.

Mines.

Cripple Creek, Col.—W. S. Montgomery and T. J. Monahan, owners of the Blue Jay on Bull Hill, have given the Spratt Brothers a lease for two years on the property. An electric hoisting plant will be put on and about 60 feet of drifting will be necessary to reach the ore.

Custer, S. D.—A complete electric drilling plant has been purchased by the Chicago Mica Company, which is working on the Crown Mica Mine, north of this city.

Automobiles.

Milwaukee, Wis.—The Milwaukee Automobile Company lately filed an amendment, increasing its capital stock from $25,000 to $35,000.

Olneyville, R. I.—It is stated that John P. Thompson succeeded in getting a sufficient amount of capital to establish an automobile company, and that it will be known as the Thompson Automobile Company.

St. Louis, Mo.—The Scott Automobile Company of 3937 Olive street, of which Charles R. Drummond is president, has filed with the recorder of deeds, articles of assignment to its secretary, W. D. Pittman, for the benefit of its creditors.

Western Port, Md.—Judge A. Hunter Boyd has appointed Taylor Morrison and F. Brooke Whiting receivers for the Maryland Automobile Company of this place.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, October 8, 1901.

STREET RAILWAY STOCKS.

NAME.	Par	Last Sale.	
	value.	Bid.	Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	35	37
Broadway and Seventh Avenue	100	245	249
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	159	159¼
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	117¼	117½
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	106	107½
Brooklyn City Railway	100	243	244
Brooklyn Rapid Transit	100	57¼	57½
Baltimore United Railways, com	50	16½	16¾
do. do. do. pref	50	91	92
Buffalo Railway	100	110	111
Cleveland City Railway	100	122	122½
Cleveland Electric Railway	100	85	85¼
Columbus (O.) Street Railway	100	45	48
Jersey City, Hoboken and Paterson	100	20	23
New Orleans City Railway, com	100	28	30
do. do. do. do. pref	100	101	105
North Jersey Street Railway	100	22	23
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	30	34
do. do. do. pref	100	85	86
St. Louis United Railways, com	100	25½	26
do. do. do. pref	100	79¾	80¼
United Electric of New Jersey	100	17½	20
PHILADELPHIA.			
American Railways	50	40¾	41
Citizens	50	359½	360
Columbus Railway	100	40	40¼
Columbus Railway, pref	100	84½	85
Consolidated Traction of New Jersey	100	67¾	68
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23⅝	24
do do pref	50	62	62½
Dayton Traction	100	156	156¼
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151¼
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J	100	..	..
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	96	96¼
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	27¼	28
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	178½	179
West End Street, com	50	94	94¼
do. do. do. pref	50	112	113
CHICAGO.			
City Railway	100	201	201½
Lake Street Elevated	100	11½	11¾
North Chicago	100	190	200
Union Traction, com	100	16½	18
do. do. pref	100	58½	85¾

STREET RAILWAY STOCKS.

NAME.	Par	Last Sale.	
	Value.	Bid.	Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23½	23⅝
do. do. do. pref	50	95¼	94
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	49	50

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par	Last Sale.	
	Value.	Bid.	Asked.
NEW YORK CITY.			
Electric Boat, com	100	16	18
do do pref	100	40	46
Electric Lead Reduction	100	1⅝	2¼
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	1½	3
do do pref	100	3¼	5
General Carriage	100	1	1⅛
General Electric	100	248	248¼
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	250	251
General Electric	100	248	248¼
Massachusetts Electric Companies, com	100	36	36½
" " " pref	100	92	92¼
Westinghouse Electric & Mfg., com	50	70	71
do do do pref	50	78	80
CHICAGO.			
Chicago Edison	100	165	165¼
National Carbon, com	100	18	18¼
do do pref	100	83	83¼
PHILADELPHIA.			
Electric Company of America	50	7	7⅛
Electric Storage Battery, com	100	60	67
do do do pref	100	60	67
General Electric Automobile	50	¼	⅝
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	5¼	5⅝
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	93	94
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141⅝

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par	Last Sale.	
	Value.	Bid.	Asked.
BOSTON.			
American Telephone & Telegraph Company	100	155¾	156
Erie Telegraph & Telephone Company	100	39	39¼
New England Telephone Company		134	135¼
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co	100	105	110
Commercial Cable Company	100	180	185
Franklin Telegraph Company	100	45	54
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	116	118
Mexican Telephone Company	100	2	2¼
New York & New Jersey Telephone Company	100	168	170
Pacific & Atlantic Telegraph	25	78	85
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		90¼	98⅝
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	116
Cumberland Telephone & Telegraph Co	50	136	140
Chesapeake & Potomac Telephone Company	100	60	65
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		75	76
Hudson River Telephone Company	100	115	120
Northwestern Telephone Company, guar	50	124	126
Providence (R. I) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Oct. 8.

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1	1¼
Eddy Electric Manufacturing Company	25	10	10¼
Storey General Electric	10	11	12
Consolidated Car Heating	100	55	57
Standard Underground Cable	100	218	220
Pratt and Whitney, pref	100	90	95

STREET RAILWAY BONDS.

ALBANY.	Last Sale.	Int. Paid.
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116¼	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅝@16⅞c.; Lake, 16¾@17c.; casting, 16½@16¾c.

President Greatsinger of the Brooklyn Rapid Transit says that the gross earnings for the year will amount to $12,000,000.

The Calumet & Hecla Mining Company has declared a dividend of $15 per share, payable October 31 to stock of record October 5.

At the annual meeting of the Southern Light and Traction Company, held in Jersey City Monday, the retiring board of directors was re-elected. The board, on organizing, re-elected the retiring officers.

Failures in the United States reported by R F. Dun & Company for the nine months of 1901 number 8,144, with an aggregate indebtedness of $97,856,416. In the same months of 1900 the number was slightly smaller, 7,895, but the amount of liabilities was much heavier, $133,234,988.

The weakest stock on the list in Wall Street Monday was Brooklyn Rapid Transit, which broke at one time nearly five points on very large transactions, involving a total of 77,000 shares, one block of 5,000 shares coming out on a single transaction. There was no specific news on the stock.

The Southern New York Toll Company was incorporated in Albany on October 4, to operate a telegraph and telephone line in a lower Hudson River County, with principal office in Albany. Capital $100,000. Among the directors are Joseph Claudet, John H. Scofield and George W. Sutton, of New Rochelle.

The Worcester Traction Company, which has owned street railways in the Massachusetts city from which it is named, at a special stockholder's meeting in Newark, N. J., on Monday voted to retire and cancel 19,600 shares of its preferred stock. The company recently sold its system to a syndicate, and may go out of business.

It can be authoritatively stated that the Amalgamated-United Metals Selling interests have definitely decided to keep the price of copper at 17 cents for Lake and 16⅝ cents for electrolytic copper. The United Metals Selling Company has been making good sized sales of copper at these figures the past week, one consumer taking 2,000,000 pounds,

General Electric "insiders" have caused to be circulated the report that "the General Electric Company will probably earn net profits, over strict maintenance, etc., of plants, of something like $8,000,000 this year. This sum would suffice to pay 20 per cent. on a capital stock of $40,000,000, at which the stock would stand after restoration of the capital reduction of 1898."

The following statement from one of the largest consumers of copper in the United States confirms the reports that the leading consumers of copper are buying from hand to mouth, having no surplus stocks on hand: "We are carrying practically no stock of copper at present, being able to get monthly supplies as needed. Therefore, we cannot be said to be carrying an excessive amount, and no stated average of the copper carried on hand can be made. I can only say that we carry, or use, about 25 per cent. less copper during the winter months than during the summer months."

A rumor has gained currency that Brooklyn Rapid Transit Company is issuing $20,000,000 of bonds. This is entirely unfounded but probably grows out of the fact that Brooklyn Rapid Transit has been putting its guarantee upon the bonds of controlled companies, with the idea of thoroughly uniting the system. The amount of $23,000,000 is because the Brooklyn Union Company has an authorized issue of $16,000,000 and Kings County an issue of $7,000,000, which makes the $23,000,000. Brooklyn Rapid Transit is applying now for the listing of $3,110,000 of Brooklyn Union bonds, the balance of the authorized issue of $16,000,000. About $12,000,000 of the bonds have been on the Stock Exchange list for some time, also the $7,000,000 of Kings County bonds. The proposed application merely completes the work that has been under way.

Sheriff Ruempler, of Hudson County, N. J., has received for service upon the legal representative of the Electric Vehicle Company papers in a suit for $704,800 brought by Richard Siegman, through the law firm of Coult & Howell, of Newark. Siegman alleges he is a stockholder in the company to the extent of 400 shares. The capitalization of the defendant company is $20,000,000. Siegman asserts the amount he sues for has been paid out by the directors of the company from the capital stock, contrary to the laws of the State of New Jersey, under which the company is incorporated. The prayer asks that the Chancery Court require of the directors an accounting and that the directors be compelled to appear in court and make discovery of the sources from which money was obtained to pay dividends.

An official of the Telephone, Telegraph & Cable Company of America says: "The reports that active opposition to the American Telephone & Telegraph Company will soon be undertaken by the Telephone, Telegraph & Cable Company are true. One of the first steps of our company will be to demand space in the subways for the wires of the Knickerbocker Telephone which is now under our control. There is every chance that this demand will be refused as the Subway Company is dominated by interests closely allied with Bell Telephone. If the demand is granted, an exorbitant rate will undoubtedly be charged with the expectation that it will prohibit our taking advantage of the grant. There is no reason, however, to assume that we will peacefully submit to an unjust treatment at the hands of our competitors. Outside of the local field, one of our first moves will undoubtedly be to establish a long-distance system to and throughout New England. Further than that, our plans are now too uncertain to make any predictions which can be considered trustworthy."

ELECTRICITY.

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EDITORIAL NOTES.

The Twentieth Street Railway Convention.

The twentieth meeting of the American Street Railway Association, which drew to a close with a banquet at Sherry's on Friday evening last, was, in the opinion of the majority of the delegates, the most successful convention yet held. This sentiment was voiced by President Holmes at the banquet in his official farewell address, when he said:

"Of all our twenty conventions this has certainly been the most nearly perfect of all. We have literally had the 'freedom of the city'—this most wonderful city of the world. We have had the unwearied attention of the bravest of men and the fairest of women. We have been 'personally conducted' by every conductor in the metropolis, from the chief executive of the city and President Vreeland, down to the smiling manipulators of the punch. Our money has been refused and our paths have been upholstered with roses. From the highest to the lowest we have received a courtesy which will not end with this matchless banquet—a courtesy which will surely yield friendships and sweet memories which will end only with the close of life."

From a technical or educational standpoint the gathering was everything that could be desired. The papers were almost without exception on topics of interest to the industry, two especially noteworthy ones being those presented by Messrs. McCormack and Pestell, entitled respectively "Relations of Interurban and City Railways," and "The Adoption of Electric Signals on Suburban and Interurban Railways of Single or Double Track and Their Economy of Operation."

The exhibits were many in number and held the attention of the visitors during the greater part of Thursday.

The proceedings of the convention will be found elsewhere in this issue.

* * *

The Brooklyn Bridge Crush Problem.

Some time ago we referred in these columns to a method that had been suggested for relieving the crush at the entrance to the Brooklyn Bridge during the morning and evening rush hours. In a word, the solution of the problem, according to the engineer quoted, was to be found in a number of moving platforms, very similar to those made use of at Paris during the last exposition. Although some such scheme might have afforded the desired relief, there were a number of almost insurmountable obstacles in the way of its adoption, and in view of this fact another solution of the problem, as suggested by a committee of experts appointed by the Commissioner of Bridges, should prove extremely interesting to the citizens of the metropolis.

One of the important changes planned is the use of looped tracks for the elevated trains, much on the principle now employed by the trolley cars. The experts, in order to increase the speed of trains crossing the bridge without making them too short, suggest that the multipie unit system of train control be adopted. The following are some of the more important recommendations made:

(1) That an elevated road be built from the Manhattan terminus of the New York and Brooklyn Bridge along Centre and Marion streets to Spring street and thence along Spring and Delancey streets to the terminus of Bridge No. 2; and that a branch of this Centre street line be built on Canal street to the terminus of Bridge No. 3. That the first named portion be completed by the time Bridge No. 3 shall be opened for travel. That that portion of this elevated road from the Bridge terminal along Centre street to Canal street be constructed with four tracks, the remainder to be double track road. That the portion of the proposed elevated road from the existing Bridge terminal to a point on Centre street, north of Worth street, be built at once, and a commodious station be built at Worth street with sidings and switches north of this section for tail-switching and returning trains.

(2) That a double-track elevated road be built as soon as practicable from the Manhattan terminus of the New York and Brooklyn Bridge southward along Park Row and across Broadway to Vesey street; thence westward along Vesey street, crossing the Sixth and Ninth avenue elevated roads above grade to West street, and southerly along West street to the vicinity of the Cortland street ferry on North River. That the terminus on West street be provided with a suitable station and such extra sidings and switches as will enable trains to be returned to the Bridge. That a commodious station be placed on Vesey street,

between Church street and West Broadway, with connection by stairs and platform to both the Sixth and Ninth avenue roads. We regard this Vesey street line as very important, and it is strongly recommended; but it is independent of the Centre street line, and its omission would not affect the other improvements recommended.

(3) That the present gallery floor (second floor) of the Manhattan terminal building be converted into and be used exclusively for a trolley car terminal, the loop tracks to be wide apart and each track to be reached by two separate stairs from the ground floor, one for outgoing and one for incoming passengers.

(4) That a commodious stairway entrance to the terminal be made at Rose street. This will not only accommodate a large number of people in that vicinity but will tend to reduce the crowd that now centers at Park Row. Plans for these stairs are already completed by the chief engineer and superintendent.

(5) That the present stairway leading from William street up to the first floor of the terminal be widened materially and made straight, and that a corresponding stairway opening into William street be built in the north side of the building. The William street stair is now one of the most crowded places about the terminal, and its capacity is entirely inadequate.

(6) That the trolley tracks and the roadway be separated from each other by curbs placed between them over the whole length of the Bridge, thus preventing vehicles from using the trolley tracks.

(7) That some plan for cleaning the roadway of the Bridge shall be devised that will not interfere with the free moving of the trolley cars and trains, and that repair work which may interfere with the travel of any kind on the Bridge be done during the hours of minimum travel.

The report indicates that the experts believe that when the new East River Bridge is completed—i. e., between two and three years—the number of persons passing over the Brooklyn Bridge will be materially decreased and that in this way relief will be afforded. This will probably be the case to a certain extent, but it should be borne in mind that each year sees more persons seeking homes in the Borough of Brooklyn and consequently too much reliance should not be placed on the new bridge drawing a very large amount of traffic from the old one. It is roughly estimated that the cost of carrying out the recommendations made by the experts will be approximately $2,700,000. If this sum of money will afford a permanent solution to the Bridge crush problem, by all means let the city spend it.

* * *

The Permanent Exhibit of Manufactures in Mexico.

The movement to establish a permanent exhibition of manufactures in the City of Mexico, mention of which was made in a recent issue of Electricity, has taken practical shape. Information has just reached Washington to the effect that the exhibit will be held in the Portirio Diaz Park, and will be opened to the public on December 25 next. Electrical manufacturers who desire to secure space and full particulars regarding the enterprise should communicate with Dr. C. De Garmo Gray or John D. Beaumann, City of Mexico. The latter is manager of the park where the exhibition is to be held.

It has been frequently pointed out by this paper that Mexico offers a great field for electrical trade, and figures have been published from time to time showing how great a hold our manufacturers have in the markets of Mexico. Fresh attention is attracted to this promising field by the proposed exhibition of American manufactures, and it will undoubtedly be of great benefit to our exporters. It should, however, go hand in hand with a more earnest disposition upon their part to meet the desires of the customers whom they wish to secure in the matter or method of packing, terms of payment, and other essential details. In this connection, it would be well for us to copy from European manufacturers, who not only study the requirements of the trade, but strive to win it by careful attention to the smallest details. Invoices should be made out in the Spanish language, the mother tongue of Mexico, and special attention should be paid to the marks and numbers, and the methods of packing suggested by the intendent importers. We would lay special stress upon this point, for it is the one on which we hear universal complaint, as the Mexicans say that our manufacturers either cannot or will not pay attention to shipping directions. These matters are the first to be considered if the proposed exhibit is to bring results in the way of increased sales of American manufactures.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

The Philadelphia firm of Dutilh-Smith, McMillan & Co. has been given an award for the construction of an electrical traction system in the southern part of England. The line is to extend from Southend-on-Sea, a prominent seaside resort about 20 miles south of London, through Shoebzuryness and Rockford to Rayleigh, a distance of about 20 miles. A contract has also been given the same company for the establishment of an electric lighting system in Southend-on-Sea.

◆

The design of the Electricity Building of the St. Louis World's Fair, to be held in 1903, has been assigned to Messrs. Walker & Kimball, architects, of St. Louis. The dimensions of the building will be 525 by 600 feet. Compared with the Electricity Building at the Columbian Exposition in Chicago, the St. Louis building will have 77,000 square feet greater area.

◆

A dispatch from Odessa to the London "Times" says that Prince Khilkoff, Russian Minister of Ways and Communications, and a party have made a successful automobile trip from Vladikavkaz, Caucasia, to Tiflis (nearly 100 miles). The journey was the first of its kind in Russia. In view of the inadequacy of railway facilities between many important towns and the general flatness of European Russia, the automobile, the dispatch says, should prove an invaluable means of communication.

◆

Plans for the erection of one of the largest schools of technology in the world have been adopted by the trustees of Carnegie Institute in Pittsburg, Pa., in accordance with an offer of Mr. Carnegie to endow and maintain such a school of the highest order in that city. The city officials of Pittsburg will be asked to contribute sixty acres of land for the site and Mr. Carnegie will be asked to give at least $5,000,000 for the maintenance of the school. The building of the school will cost several millions more. All the plans and suggestions have been collected and embodied in a comprehensive report which will be sent to Mr. Carnegie for his approval. A committee on municipal relations was appointed by the trustees to confer with the city authorities of Pittsburg at once in regard to the donation of the land.

◆

E. A. Burdick and Francis G. Hall, Jr., the inventors of a submarine electric light, are said to have been engaged by the Italian Government to construct lights which will be used on the Italian submarine vessel Delfino. This vessel has been carrying on a series of experiments under the direction of the Minister of Marine with lighting devices, which allow persons on board to see all that is going on above the surface of the water although the boat and its occupants are invisible. These experiments have been conducted with great secrecy and the success they have attained is expected to give the Italian Navy a tremendous advantage in submarine warfare.

◆

A part of the second section of the underground tunnel, between Bleecker and Prince streets in this city, has been completed save for the laying of the rails, and on October 10 it was illuminated by electric lights, and one could judge how the big "hole in the ground" will appear. Electric lights have been placed 30 feet apart and 4 feet from the base of the rails. The tunnel is enameled and beneath the electric lights presented a glittering appearance. The engineers of the Rapid Transit Railway made a tour of inspection from City Hall northward on the day mentioned and reached the completed section about noon.

◆

The advisability of installing electric headlights on all its engines is now being considered by officials of the Pennsylvania system. The matter of having such lights on the engines has been considered by different roads throughout the country during the past few years, and not until a few months ago was the question considered feasible. The cost of equipping the engines with electric light was the chief drawback to adopting such illumination, but since the price of oil has been increased the officials have been preparing to have the engines lighted by this method.

◆

The Cunard line steamer Lucania, signaled the New York "Herald's" wireless observation station, on the South Shoals Lightship, at 1:20 o'clock on the afternoon of October 11, when she was fully 85 miles east of Nantucket. The Lucania was in communication with the lightship up to 8:15 o'clock. During this time several messages of a social nature were transmitted by passengers to friends on shore.

◆

Nearly a billion and a quarter dollars is the enormous sum of money which the United States Treasury has now in its possession. Of this $534,000,000 is in gold, and nearly $500,000,000 in silver.

PRESIDENT H. H. VREELAND.

Mr. Herbert H. Vreeland, the newly elected president of the American Street Railway Association, was born at Glen, N. Y., some forty-three years ago. As his father, who was a clergyman, was not well off in this world's goods, Mr. Vreeland was obliged to go to work at the age of ten driving a grocery wagon in Jersey City. Three years later found him, to use his own reminiscent phrase, "h'isting ice" on the Hudson River, one of a gang of eighteen or twenty men and boys, filling the ice carts for retail city delivery.

Mr. Vreeland first entered the railroad business in 1875, shoveling gravel on one of the Long Island Railroad Company's night construction trains. He next acted as switchman for the same road, then as brakeman and conductor. Finally the road changed hands, and in 1881 Mr. Vreeland secured a position as conductor on the New York and Northern Railroad. It was while in this position that the chance in life, that all seek but so few find, came to him. The road was purchased by William C. Whitney and others, who went over the line in a special train to visit the property. Knowing the road thoroughly Mr. Vreeland was able to answer all the questions which they raised. As a result of this the conductor was promoted to the position of general manager.

A short time after this, according to Mr. Vreeland's own statement, which appears in "Success," he was summoned to meet Mr. Whitney at the office of the Houston Street, West Street & Pavonia Ferry Railroad Company, a small horse railway just then purchased by what is to-day known as the "Whitney Syndicate." On reaching the office Mr. Vreeland found that Mr. Whitney was absent, but a letter was handed him. The rest is best told in Mr. Veeland's own words as they apappear in the paper quoted above:

"I took my letter and sat down outside, thinking that it might possibly contain an appointment for another hour. It was, however, an appointment of quite a different character. It read as follows:

'Mr. H. H. Vreeland.

'Dear Sir: At a meeting of the stockholders of the Houston Street, West Street & Pavonia Ferry Railroad Company, held this day, you were unanimously elected a director of the company.

'At a subsequent meeting of the directors, you were unanimously elected president and general manager, your duties to commence immediately.

'Yours truly,
'C. E. Warren, Secretary.'

"By the time I had recovered from my surprise at learning that I was no longer a steam-railroad, but a street-railroad man, Mr. Whitney and others came in, and, after spending about five minutes in introductions, they took up their hats and left, saying, simply, 'Well, Vreeland, you are president; now run the road.' I then set out to learn what kind of a toy railway it was that had come into my charge."

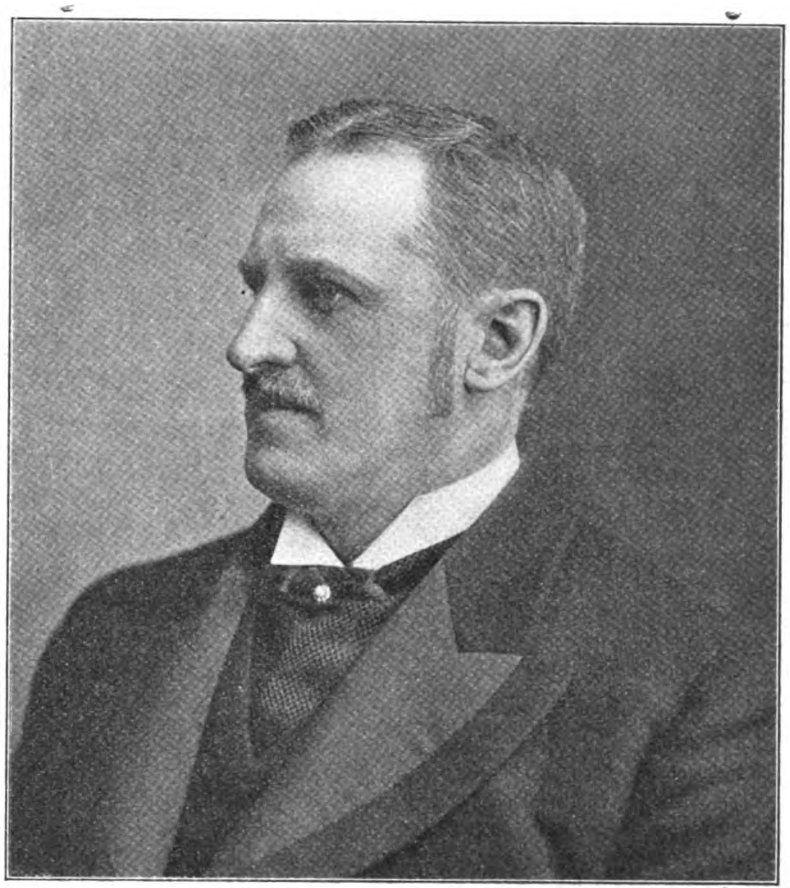
Thus did Mr. Vreeland become the head of what is to-day known as the Metropolitan Street Railway Company, undoubtedly the greatest and most up-to-date system of street railways in the world, which fact may be attributed to the ability, untiring efforts and wonderful foresight of the boy who started in life by driving a delivery wagon thirty-three years ago.

American Street Railway Association Convention.

The Twentieth Annual Meeting in New York Very Largely Attended—H. H. Vreeland Elected President—The Next Convention to be Held in Detroit, Mich.

The twentieth meeting of the American Street Railway Association was called to order by President Walton H. Holmes at 10:45 o'clock on the morning of October 9 in Madison Square Garden.

President Holmes introduced Mr. Randolph Guggenheimer, President of the Municipal Council of New York City, who delivered an address of welcome in part as follows:



H. H. Vreeland,
President of the American Street Railway Association.

Mr. President and members of the American Street Railway Association:—In the name of the City of New York, which I have the honor to represent on this occasion, I welcome the delegates of your association to the metropolis. It is not necessary for me to have a technical knowledge of railway management to say that you have acted wisely in selecting New York as the meeting place of your association for this year. We are proud of our city because we believe that it is pre-eminent among all the world's municipalities in many respects, and especially in its street railway system. There was a time not many years ago when President Vreeland would not have found it difficult to solve the problems of street transportation in the old City of New York. Then stages, drawn at the breakneck speed of four miles an hour, carried passengers as far north on the Island of Manhattan as 23d street. A great transformation was wrought by the laying down of horse car lines in various avenues and streets, until at last the usefulness of the horse was threatened by the adoption of the cable on Broadway and Lexington avenue. At that time New York City seemed to be contented with antiquated methods, because even in the neighboring city of Brooklyn, the overhead trolley was doing a rushing and killing business. We yield the palm of superiority even to Philadelphia in the matter of speed and the number of slain pedestrians. But I can congratulate President Vreeland and the Metropolitan Street Railway Company upon their adoption of the sub-trolley system, which, in my opinion, is the only reasonable solution of urban transportation. At the present moment the City of New York, as far as the lines of the Metropolitan Street Railway are concerned, possesses the most perfect and the most rational street car service not only in the United States but in the whole world. I venture now, with great diffidence, lest the presidents of other lines should be present and resent my words, to hope that, in the not distant future, the underground trolley will be adopted in every borough in the city.

The street railway business, especially during the last twenty-five years, has become one of the most important and colossal of all the industries in the United States and contributes materially to the welfare of the people. It does so in many ways. A calculation of the number of men employed in street railroad work throughout the country would show that intramural transportation companies are the means of sustaining a larger number of families than the statistician would at first sight imagine. But in addition to the unconscious benevolence displayed by the bond and stock holders of the various street railroad corporations, throughout the United States, they perform a public duty of incalculable value to a greater degree to-day than at any previous period in our history. The operations of commerce depend upon the efficiency of your transportation lines. If it be true that time is money and that the saving of time means success, I cannot understand to-day how the business of the community was efficiently performed when it required as long a time to journey from Harlem to the business districts of this city as it does now to reach New York from Albany.

Again, Mr. President and members of the American Street Railway Association, in the name of the city of New York, I bid you a most cordial welcome to the metropolis. I trust that all the members of your society will bring to your homes the pleasantest possible memories of your visit to New York and that your convention may prove, both socially and professionally, the success which it so eminently deserves. I know that I am simply speaking for the people of this community when I express my most earnest hope that the American Street Railway Association will be so well pleased with their visit that they will soon again select the city of New York for the purpose of holding their annual convention.

Let me thank you again for your courteous reception.

President Holmes—Mr. Guggenheimer, allow me in the name of the American Street Railway Association to thank you most heartily for your kind words of welcome.

We will now proceed with the regular order of business. The first business on the programme is the calling of the roll. As it is customary to take the registration at the door for the roll call, we will dispense with the calling of the roll.

The next order of business is the address of the President.

President Holmes then delivered the following address.

Gentlemen—It is extremely appropriate that the 20th session of the American Street Railway Association should be held in the City of Greater New York.

In acknowledging the kindly spirit of hospitality pervading the address of welcome to which we have just listened, I but feebly voice the feeling of every member of the association when I say that not the slightest doubt was ever entertained but that our meeting in this great metropolis of America would prove to be the most enjoyable and profitable in its history. I am assured that every desirable arrangement has been made for our comfort and entertainment; an assurance entirely unnecessary from the gentlemen who have these matters in charge. Personally, I have the highest pleasure in meeting with you on this auspicious occasion, and I extend to one and all my hearty congratulations that once more we are gathered together in convention under circumstances and environment which guarantee that the best interests of the association will be promoted and greatly enhanced thereby, and that we will return to our homes refreshed and stimulated by pleasant memories, and inspired to still higher efforts and greater success in our calling by the light of the experience, thought and fellowship of successful brethren working to a common end.

Since the last meeting of this association the President of these United States has been taken away by the ruthless hand of an assassin. It has been truly said of Mr. McKinley that he was the most beloved of all our Presidents while in office. His kindly disposition and sincerity of purpose attracted all men to him in such marked degree that through his example and influence the last vestige of sectionalism has been happily removed from our common country. Great as was the loss in his taking off, it was not without some compensating advantages. It has served to arouse and unite the whole civilized world in one common bond of sympathy and to teach us, as well as anarchy, that the foundations of our Government, being laid deep and lasting in the principles of liberty, right and justice, are not to be even momentarily shaken by an assault on the Chief Magistrate, however successful. By this unhappy event business was nowhere seriously disturbed except by its voluntary cessation for a short period, actuated by universal patriotism and sincere grief that a great and good man had been so cruelly and causelessly removed from the service of the country which he has loved so devotedly and served so faithfully and so well. Peace to his ashes; and may the red hand of anarchy never be seen in our midst again.

At a session of the Executive Committee held in the early spring, your President appointed a committee on standardizing of street railway equipment, know as the Standardizing Committee. This committee, I am informed, has given the subject very careful thought and consideration, and at the proper time the result of their deliberations will be reported to you. In my judgment no more important subject looking to permanent improvement in street railway conditions could engage your attention, and when the report comes in I trust it will receive the full measure of discussion which the question deserves. While the views reported will be of great value in themselves, they will stand out in still bolder relief in the light of a full and intelligent discussion. I am so impressed with the importance of this problem that I beg to suggest the propriety of its continued study and investigation through committee until substantial results are obtained.

The past year has been one of peace and prosperity in the street railway business. No serious labor troubles have occurred, no doubt due to the fact that a better understanding is constantly being brought about between employers and the employed. Managers and men are everwhere being brought closely together, with the result that misunderstandings, often due to unauthorized acts of subordinates, are of much less frequent occurrence. Imaginary grievances are often more serious than real ones, and generally more difficult of settlement.

The standard of construction and equipment continues to grow more and more substantial and expensive, contributing measurably to the comfort of street railway patrons. The electric street car of to-day is a palace on wheels compared with the horse coach of twenty-five years ago. The highest degree of comfort is being rapidly attained, and every day gives evidence that the well equipped street railway has passed beyond the stage of a mere necessity of convenience and is looked upon by a very large percentage of the community as a primary source of pleasure and enjoyment. The street railway manager is nothing more or less than a merchant, selling rides on a large scale. The profit on each ride is so small that money is to be made only by doing a large business. This fact every competent manager fully realizes, and hence it is that he is ever willing to introduce improvements everywhere, even to the extent of discarding substantial and valuable equipment whenever it can be seen that such action will bring anything like an adequate return in the way of increased patronage. His unremitting endeavor is to induce people to patronize the cars and to that end is constantly providing for them attractions in the way of parks and amusements in great variety. Wherever public parks or places of amusement are to be found the efforts of the authorities in that direction are supplemented by the street railway manager, who supplies them with attractions and exhibitions which would otherwise be wanting.

The time to be occupied by the deliberations of this association has been limited to three days, the whole of Thursday, according to the progress made by the Executive Committee, being set apart for the consideration of the exhibits made by the supply men. The action of the Executive Committee in thus emphasizing the importance of these exhibits I have no doubt will meet with your hearty approval. They contain all that is new and valuable to be known in the machinery and appliances pertaining to the business in which we are engaged. A careful and discriminating study of them is almost an education in itself. They have been brought from everywhere, in many instances from great distances at large expense, and are displayed in a manner most attractive and instructive. It is but right that this substantial recognition should be made of this exceedingly valuable feature of these conventions.

I trust that the members of this association will take particular interest in the work of the Accountants' Association which is assembled here in convention at this time. They are accomplishing much of value in their special department, and by the work they are doing are greatly facilitating the interchange of desirable information and promoting the safe and economical administration of the affairs of street railway companies.

It gives me great pleasure to be able to state that the present condition of this association is the most healthy and prosperous in its history. During the past year its membership has greatly increased and its bank account is in a most satisfactory condition. No more convincing testimony could be given of the usefulness of the association and of the reason for its existence.

The thanks of the association are due to the Secretary and the Executive Committee for the able and successful manner in which they have conducted its affairs during the past year.

In closing, permit me to say that the honor which you have conferred upon me is most highly appreciated. To be the President of this association is an honor of which any man might well be proud, and I shall ever esteem the compliment paid me in my selection to preside over your deliberations, as the brightest jewel in the crown of whatever success I may have achieved as a street railway man. If my administration of the high office has been a success it has been due more to the kind and considerate support and co-operation of others than to any merit of my own. I can bespeak for my successor no greater surety of success than to be accorded the same generous treatment. Gentlemen of the association, I thank you.

President Holmes—The Report of the Executive Committee is in order. The report of this committee consists of the minutes of the meetings of the committee.

On motion the report of the Executive Committee was received and filed.

President Holmes—We will now listen to the report of the Secretary and Treasurer.

Secretary Penington then read his report, which showed that on October 1, 1901, there was a balance of $10,128.68 on hand.

Mr. Wyman—I move, Mr. President, that the report of the Secretary and Treasurer be accepted and spread upon the minutes, accompanied with the congratulations of the delegates on the exceedingly good showing which appears. The motion was put and carried.

The report of the Committee on "Memorials of Deceased Members" was presented, was adopted and made a part of the minutes of the meeting.

Secretary Penington announced that the Compressed Air Company of Rome, N. Y., invited the delegates to visit its works and inspect its plant for manufacturing compressed air motors; also that the Bethlehem Steel Company of South Bethlehem, Pa., invited the delegates to visit its plant on Saturday, special cars being provided for that purpose. Also that the badges of the association would be honored on all the street and elevated lines in New York, Brooklyn, Long Island City, Jersey City and Hoboken, as well as entitling the holders to the free service of the local and long distance telephones and the use of messengers of the American District Telegraph Company.

President Holmes—The papers by Mr. Robert McCulloch, of Chicago, on "Street Railways: A Review of the Past and a Forecast of the Future;" by Charles S. Sergeant, of Boston, "On the Public, the Operator and the Company;" and by Mr. George W. Baumhoff, of St. Louis, on "The American Street Railway Association; the Purposes of its Organization and the Benefits Accruing to investors in, and Operators of Street Railway Properties by Membership Therein," being printed, and having been distributed to the members, will not be read; the papers do not seem to admit of very much discussion, but if any member desires to discuss them we would be pleased to hear from them.

Secretary Penington then read a letter from Captain McCulloch regretting his inability to be present at the meeting for the reason that nearly all his heads of department had left Chicago to attend the convention.

President Holmes—The paper by Mr. Ira A. McCormack, general manager of the Cleveland Electric Railway Company, on the "Relations of Interurban and City Railways," will now be considered. I will ask Mr. McCormack to make a brief statement of the contents of his paper.

Mr. McCormack—I did not expect to be called upon to make any remarks, as I supposed the paper would speak for itself. There is, however, one thing I would speak of in connection with the paper and that is in getting information from different companies in relation to traffic agreements I find that a great many general managers are reluctant to give any such information. As stated in the paper, one street railway operator put it in this way: "We had hard work arriving at an agreement and we do not propose to educate our competitors." Another railway man whom we asked for information about agreements between interurban roads and city roads stated that he did not have any agreements; that he proposed to run all the roads radiating from his city as part of his system. In writing this paper it was a surprise to me to find that it is in the Western cities that the traffic agreements are made between interurban roads and city roads, and that very few of these agreements are made among the street railways in the East. The absence of these agreements in the East may be accounted for probably on the principle of the general manager who said that if there were any roads to be run into the suburban districts they proposed to build them and operate them.

I have received a letter from the Columbus Railway Company which says: "We note in your paper on the relations of interurban roads with city roads a paragraph wherein you state that an agreement has been recently made between an interurban road and this company, whereby the interurban road is to stand the expense of installing the third rail to accommodate the standard gauge to our broad gauge. While the franchise granted to this company permits such an agreement under certain conditions, yet no such steps have been taken or agreement made, but it is doubtful as to whether such an arrangement would at any time be made." It appears that my paper should have stated that the right to make such an agreement was provided in the franchise, but that no such agreement had been made.

In the paper it is stated that the price of coal in Denver would probably make it necessary to receive a greater rate of compensation than in some other cities, some Eastern cities for instance, where coal was not so dear. Since writing the paper I have been informed that coal is just as cheap in Denver as in some other cities, and I would recommend that San Francisco be substituted for Denver.

A discussion of the paper ensued which was participated in by Messrs. Lang, Crosby, Gray Myers, Nicholls, McCormack and Davidson.

The meeting then adjourned until 2:30 P. M.

Wednesday, Oct. 9—Afternoon Session.

The discussion of Mr. McCormack's paper was continued, Messrs. Roberts, Crosby, Mason, Hopkins, Connette, Parker and others taking part.

President Holmes—In view of the fact that quite a number of papers are to be brought before this convention, if we do not take up another one very soon I am afraid Mr. Vreeland will have us with him for a considerable time. I think we had better close the discussion and take up Mr. Chamberlain's paper, and I will ask Mr. Chamberlain to come up on the platform and we will give him five minutes to point out the essential features of his paper. I take pleasure in introducing to you Mr. Eugene Chamberlain, of Brooklyn, who has prepared a paper on the street car best adapted for city use.

Mr. Chamberlain then read his paper, which was discussed by Messrs. Beggs, Sergeant, Fuller, Wason, and Davidson.

President Holmes—We will now take up a paper by Mr. M. S. Hopkins, of Columbus, O., entitled "Alternating and Direct Current Transmission on City Lines."

Mr. Hopkins—In preparing this paper I have had principally in mind the conditions which have been confronting me at Columbus, namely, as to whether I would put up additional copper to supply the needed current for outlying districts or put in an alternating current system with the sub-stations located out near the extreme portions of the city.

The one question with me has been the advisability of having the two kinds of current in the power house, that is, having one unit of direct, the next unit of alternating; and as to whether the maximum capacity of a station could be made available at all times with an arrangement of that kind.

In order to get at just what our losses were in the feeder system, I had a wattmeter installed in the outlying districts, one a wattmeter at the car station and one where the feeder taps on to the trolley wire and run for a period of time. The difference between the readings of these two wattmeters being the actual loss in kilowatt hours during the transmission of the current. On the East Long street section it ran 23 per cent., covering a period of two weeks averaging 18 hours per day. On East Oak street it ran 31.2 per cent.; on the East Main street section 27.4; on the South High street section 27.8 and on the North High street section (the lower side) 25 per cent.

During the period of extremely heavy travel these losses ran up as high as 50 per cent. or over and our transportation department has been severely hampered for some time owing to lack of sufficient voltage to maintain schedules during heavy loads.

It has been with exceeding interest that I have noted the development in polyphase alternating current apparatus and several reliable methods of installing and handling high voltage circuits of large power; and it would seem to me now as if this apparatus has reached its age of development where it would warrant companies in making further additions to their power stations with an alternating current apparatus and locating the rotary sub-stations at convenient points over the line. They can do this and receive for redistributing copper to be supplied by rotary sub-stations and they will receive a graded change, quite a decided change on the cost of sub-station apparatus.

In our particular case of rotary sub-stations for supplying the outlying districts, we supplied 153,000 pounds of copper, which would have a market value of about $27,000. The high potential copper to take the place of this low potential copper would amount to approximately $10,000, which would leave about $17,000 to be credited to the sub-station, because the plan which I have attempted to outline should keep the loss well within 15 per cent. between the main station and sub-station bus-bars, even during periods of heavy travel, which would result in a saving of $3,804 in the yearly transmission of average load from station to sub-station bus-bar. In this case, owing to the location of sub stations and interconnecting of direct current feeders, the loss will not exceed the loss now existing from the points where direct current feeders now tap and where the wattmeter readings were taken to the car, hence we have $3,804 as the net saving in cost of power due to high tension transmission, being equivalent to about 12 per cent on the cost of the investment in the sub-station, which would seem profitable, not considering the great advantage in having good voltage at the end of the lines, enabling them to maintain schedule speed of cars at all times.

President Holmes—I am going to ask Mr. Crosby to open the discussion.

Mr. Crosby—Mr. President, it has been impossible during the few minutes the pamphlet has been in my hands to note whether the distances involved are stated in this paper or not. In order that any general rule might be worked out, this should be detailed; I think the elements involved would necessarily have to be known. In other words, where a city is a very compact one, it will rarely arise that you will need the alternating current. It would have been, I think, helpful if the author had, after stating his case, carefully given an indication of what distances would suggest the proper use of the alternating current. It would be an exceedingly difficult discussion to carry on in this sort of a convention. It is perhaps too technical for any proper treatment here and would require a careful examination. I think it therefore almost impossible to add anything of interest.

In a city of the general size of Utica the use of alternating current for railway service did not at all seem desirable until the question came up of suburban roads, which roads in one case were 16 miles, in another case 12 miles, and in another case 11 miles from the center of the city, and when those cases arose it did seem to be the fact that the alternating current should be used for transmission on those outside lines; in the meantime keeping all the inside business within the direct service. I think that this paper may throw some light on the subject.

Mr. Hopkins—I might say, Mr. President, in regard to one part of this paper, it would seem desirable to use this voltage on transmission lines consisting of three No. 4 B. & S. feeders from the Spring street power station to Milo, a distance of two miles, that that sub-station was to take the place of a steam station. We have two steam power plants which we operate most of the time. Our idea was to locate one rotary a distance of two miles, to take the place of the present steam station.

President Holmes—Is there any one that cares to discuss this subject? If not, we will close the discussion of the papers for the day. I will announce the nominating committee to select the place for the next convention, also to select an executive committee for the ensuing year.

The following gentlemen have been selected to act as your nominating committee: Charles S. Sergeant, Boston, chairman; Albion E. Lang, Toledo; Frank L. Fuller, Wilkes-Barre, Pa.; H. M. Sloan, Chicago; W. W. Wheatly, New York.

It is now in order for any who are present to extend to this association an invitation to visit their city the coming year. It has been customary at our former conventions to have those who care to invite us to be their guests for the coming year to do so and have it go before the nominating committee. If there are any such here this afternoon, we shall be glad to hear from them.

To-morrow we set apart to inspect the exhibits. There will be no meeting in this hall until Friday morning. In view of the fact that we have a large amount of unfinished business. I think it would be well to begin our meeting promptly Friday morning at 9:30, and as there is no further business we will adjourn until Friday morning at 9:30.

Friday, Oct. 11—Morning Session.

President Holmes called the meeting to order 10.30 o'clock.

The Secretary read a telegram from W. C. Ely regretting his inability to be present at the convention.

President Holmes—The first business this morning is the reading of Mr. Connette's paper on "The Best Manner and Mode of Conducting the Return Circuit to the Power House."

Messrs. Roberts, Harrington and Myers discussed the paper.

President Holmes—We will now take up the paper on "The Values of Storage Batteries as Auxiliaries to Power Plants," by Mr. W. E. Harrington of Camden, N. J.

After Mr. Harrington presented the paper the President asked Colonel Heft of New Haven if he could enlighten the members on the subject.

Col. Heft—I am sorry to say that my experience with storage batteries has not been very satisfactory, judging from the commercial side of it. We have eight installations and they have been very expensive to maintain, and until the makers of storage batteries can develop a storage battery of more satisfactory type than those which they are producing at the present date I would not recommend installing any more storage batteries.

Several of the members discussed the paper thoroughly, and President Holmes informed the author that the association appreciated his work in preparing the paper in such a scientific way.

President Holmes—We will now hear the report of the Committee on Standardizing.

Mr. Graham read the report and informed the members that the committee had collected a lot of data and material which would be turned over to a new committee.

It was resolved that the report of the committee be received and spread upon the minutes; that the thanks of the convention be extended to the committee, and that the Executive Committee choose another committee for the ensuing year.

The convention then adjourned until 2 P.M.

Friday—Afternoon Session.

President Holmes called the meeting to order at 2:45 oclock, and said the first paper to be considered was entitled "The Modern Power House, Including the Use of Cooling Towers for Condensing Purposes," by Mr. J. H. Vail of Philadelphia.

The paper was discussed by Messrs. Crosby, Heft, Harrington, Sloan and Uhlenhaut.

President Holmes—We will now have Mr. William Pestell's paper on "The Adoption of Electric Signals on Suburban and Interurban Railways of Single or Double Track and Their Economy of Operation."

[Mr. Pestell's paper is printed in full in this week's issue of Electricity.—Ed.]

Messrs. Vreeland, Wheatly, McCulloch, Fuller, Crosby, Wason, Baker, Sergeant and Powers participated in the discussion.

President Holmes called for the report of the Nominating Committee. The committee recommended as nominees for officers of the association the following names:

President—H. H. Vreeland, New York.

First Vice-President—C. W. Wason, Cleveland.

Second Vice-President—E. C. Foster, Boston.

Third Vice-President—H. H. Sloan, Chicago.

Secretary and Treasurer—T. C. Penington, Chicago.

Members of the Executive Committee—Walton H. Holmes, Kansas City; John A. Rigg, Reading, Pa.; D. B. Dyer, Augusta, Ga.; T. J. Nicholl, Rochester, N. Y., and G. W. Dickenson, Seattle, Wash.

On motion of Colonel Heft the Secretary cast one vote for the nominations as read.

The Nominating Committee's recommendation to accept the Everett-Moore Syndicate invitation to hold the next convention in Detriot, Mich., was unanimously adopted.

The association then passed a vote of thanks to President Holmes for the able and impartial manner in which he presided over the deliberations, and also to the various companies who had extended favors to the members.

The question of securing an increase in the rate per mile for handling the mails of the Government was referred to the Executive Committee for future action.

The convention then adjourned to reconvene at 7:30 o'clock at Sherry's when the installation of officers occurred—closing the work of the twentieth annual meeting.

THE ADOPTION OF ELECTRIC SIGNALS ON SUBURBAN AND INTERURBAN RAILWAYS OF SINGLE OR DOUBLE TRACK AND THEIR ECONOMY OF OPERATION.*

BY WILLIAM PESTELL.

The subject of signals for electric railways is of the greatest importance and is receiving, very deservedly, a great deal of attention among practical railroad men, in all sections of the country, at the present time.

The necessity of some system of signaling becomes more pronounced as the weight and size of cars increase the volume of traffic and the speed at which our cars are run is increased.

The delays and inconveniences arising from the operation of suburban and interurban roads without a properly designed signal system adapted for the service are only too apparent, and become more pronounced as we examine into and get into closer touch with the various signal systems that are to-day being tried in the various sections of the country. Whatever signals have been introduced for street railway work, even though their operation has not been perfectly satisfactory, they have illustrated the fact that delays can be reduced and a schedule maintained in a more satisfactory manner.

Signaling as applied to steam railroads for some years has been in satisfactory and general use, and has been brought to a high state of perfection and efficiency. Apparatus such as applies to steam roads would be practically of no use in street car service, as the conditions governing the operation are so entirely different.

The use of signals on steam railroads is mostly for double track lines, and is principally for keeping a proper difference between trains going in the same direction.

At the present time it seems doubtful if this class of signals would be required on street railways, but if the necessity should arise, some form of signal now in general use on steam railroads could be adapted to the purpose.

On steam railroads where temporary increase in traffic demands a greater carrying capacity more cars are added to the train, the train still being maintained as a unit, so far as its effect on the signal system is concerned. On street railway service the conditions are not usually such that this can be conveniently accomplished, and it is necessary to send out several cars, each detached from the other, and all working to maintain the same schedule. As these cars cannot ordinarily keep in sufficiently close touch with each other to indicate their location, it complicates the work to be done, by a signal system, to properly take care of their operation. It is not always safe to depend upon the crew of one car, notifying the crew of another car at a passing point of cars that are due to follow, to pass at the same point. Different roads use various means to obtain this end, even when no signal syssem is in use. Some by attaching signs to the dasher of the car, indicating that another car is to follow; these the crew on the car waiting at the turnout are supposed to observe, and are not to leave until the last car, which should have no sign on the dasher, has passed. On steam railroads, stopping places where passengers are to be taken on or let off, are practically a constant factor, and are comparatively long distances apart. This has the effect of allowing trains to keep to their schedule more easily, and obviates the necessity of frequent orders from train dispatchers.

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*Paper read at the 20th Annual Convention of the American Street Railway Association, held in New York City, October 9-11, 1901.

In cases of necessity of change of orders to a train crew on a steam railroad the telegraph is almost universally used. The presence of employes at every stopping place along the line renders this easy of accomplishment with out the loss of valuable time or chance of costly mistakes.

The telephone is rapidly being introduced along the lines of street railways for this purpose, but the street railway companies are at a disadvantage in the use of the telephone, in not having men permanently located at frequent points along the line of the road, and having to depend on the car crews for one end of their dispatcher system, much valuable time is lost in receiving and imparting the necessary information.

Another defect of the telephone system for dispatcher work on street railways is the inability to reach car crews at the time required and the likelihood of several crews trying to use the 'phone on different points of the line at the same time.

It is not intended to convey the idea that the telephone is not desirable as an aid in operating street railway systems, but that the telephone of itself for general use is not to be wholly relied upon.

In connection with a reliable signal system it should be of inestimable value, as the use for dispatcher work would be reduced to a minimum, and with proper rules, intelligently followed, practically all conditions could be provided for, giving the single track road its maximum efficiency and putting it more nearly on the basis of a double track road.

Where the necessity of a signal system on electric roads seems to be generally indicated is on single track roads, both for suburban and interurban service, city service usually requiring special applications to cover local conditions.

The object of a signal system for such purpose would be to indicate a safe passing point for cars going in opposite directions, giving single track roads with fairly frequent passing points more nearly the same operating conditions as those of double track roads, thus avoiding delays and maintaining the schedule.

The experience of steam railroads in the use of signals, their reliability and the confidence now placed in them makes it reasonable to suppose that equally good apparatus would be developed on the vast mileage of electric railways represented by this association.

Different signals for day and night use (as disks or semaphores by day and different colored lights at night) seem to be thoroughly established for any class of signal work, as regardless of the purpose for which a signal is set it should always be easily discernible.

All signals will add certain elements of danger due to chances of failure inherent in every piece of mechanism. It is therefore important to select a signal with the chances of failure so slight that only the added safety resulting from its use need be considered. The use of block signals on steam roads has reduced the liability of rear end collisions, and yet were the signals of such construction as to be unreliable the danger would be greater with than without the signals.

In this connection it would be well to note the care bestowed by steam roads on their signals. They employ trained mechanics, whose duty it is to see that all signals are properly inspected and maintained. An electric road usually puts its signal under the care of a lineman, or some other man who may know but little of either their principle or mechanical construction. It is natural to suppose that as the use of signals increases more care will be bestowed upon their inspection and maintenance.

The first and most essential element to be considered in connection with any signal system is that of safety, and no signal should be considered unless its reliability can be demonstrated to such an extent that it adds to the safety of operation of the road.

Among the various types of signals in use we find those depending wholly on incandescent lamps, those depending wholly on semaphores or disks illuminated at night, and those depending on disks or semaphores by day and upon colored lights at night for their visual indication.

Another type of signal is that which leaves the trolley wire dead on the entering side of turnout ahead and leaving side of turnout behind, thus preventing a car, from either end of the block, entering until block is clear.

Again we find various devices in use for operating the above types of signals. First, the manually operated switch, which has been in use for perhaps the longest time and is generally conceded a failure, owing to the fact that the men cannot be relied upon for its proper operation. Second, we have the rail contact devices, which have been very little used, and so far as I can learn are not generally exploited. Third, we have switches operated automatically by the passing of the trolley, which are coming into more general use as the state of the signal art progresses.

These may be divided again into several classes. One in which a contact is simply made by the wheel sliding upon a contact surface normally insulated from the trolley wire. Another, operating a switch mechanism by the passing of the trolley, making various connections, selected according to the direction the trolley passes under the switch. Still another in which the mechanical work of the signal is partly done by the trolley in passing under the switch. Each of these types of signals and switches in service may have a particular value for the location to be protected; it would be unwise at this time to make any recommendation covering general conditions. The following is a copy of resolutions drawn up by a committee appointed by the Massachusetts Street Railway Association, on which the writer had the privilege to serve:

The committee appointed by the Massachusetts Street Railway Association on the "Recommendation of Electric Signals for Street Railway Service" would make the following recommendations:

That a telephone system in conjunction with a proper block system is necessary for a safely and satisfactorily operated suburban single track road.

That it is impossible to make any recommendations to cover the needs of general city traffic, the necessities of the same being largely determined by conditions entirely local.

That the telephone system should be owned and operated by the railway company.

That a system of selective signals should be used in connection with the telephone system, to call outside telephone stations.

The block signal system should be entirely automatic, should contain a minimum number of parts; should contain some other means of visual signal besides incandescent lamps, should not depend upon incandescent lamps for continuity of circuits; should set as far as danger end at first and be locked at danger before it is possible to operate cautionary signal at near end; should not burn out under ordinary conditions of contact with live parts of trolley system. Should be normally at danger and cannot be set at safety unless all parts are in normal working condition; that signal, after being set at danger cannot return to safety unless all cars that have gone onto block have gone off again; should be capable of working satisfactorily from 200 to 600 volts, and should be of the best possible construction, mechanically and electrically.

The following is a copy of blank sent out to various street railways throughout the country to enable the writer to get a fair idea of the extent of the use of signals for street railway work, a general idea of the defects existing, the economies produced, and the apparent demand for a signal of any kind:

Have you signals in use?
How long?
What kind and make?
On single or double track?
Suburban or interurban?
Are they satisfactory?
Are they reliable?
What particular trouble have you had with them?
Do they affect the economy of operation?
How?
Are they affected by lightning?
In what respect is the signal in use on your road lacking?
Do you desire signals on your road?
For what purpose?
Would they affect the economy of operation?
How?
What particular requirements are necessary in a signal for your service?

The general idea prevalent seemed to be that signals were not required for double track work, but were required for signal track work, producing economy where in use, by dispensing with flagmen in some places and as some have stated "by indicating the position of cars and thereby enabling the schedule to be better maintained under extraordinary conditions." The principal defects noted were the fact that signals were not absolutely reliable and were generally affected by lightning. Also their lack of ability to indicate more than one car on a block at a time, that is, the first car passing off the block sets the signal to normal condition giving no indication of any other cars that might be on the block.

It has not been the purpose of the writer to go into the details of the different devices gotten out for use as signals for street railway work, or to criticize or recommend any particular type or make. A number of signals of various types are now on the market, and while from the standpoint of the writer they are all in more or less experimental state, they are deserving of every encouragement, for until the various conditions of our service have been thoroughly brought out and enlarged upon, by both the operators and signal engineers, no satisfactory device can be produced.

The street railways generally manifest a great deal of interest in the question of signals, and I would therefore recommend to your association that, owing to the present apparent experimental condition, this matter be further followed up and a report be submitted to the next meeting of the association. I regret that the press of business since my acceptance of the honor of writing this paper has been such that I have been unable to devote the time necessary to obtain and properly work up the data for a paper dealing with such an important subject.

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MISCELLANEOUS NOTES OF INTEREST TO CENTRAL STATION MEN.—IX.

BY W. H. WAKEMAN.

Irresponsible engine builders resort to various devices to cover up blunders, and so get their pay for worthless work. One of the worst cases of this kind that I ever knew of was the fly wheel of an engine which wobbled badly. As it would spoil the rim to turn it true, the builder proceeded to saw one of the arms partially off, near the hub, and then drove a wedge into the slot thus made. This sprung the rim nearly into place, so that it wobbled but very little. Paint and varnish partially concealed the defect so that the engine was sold and paid for.

If the speed of this wheel is increased to the limit for a sound wheel, it will fail and unless the broken parts are carefully examined the wreck will be voted another mysterious dispensation of Providence. In another case the cylinder of an engine proved to be defective when bored out, and the builder proceeded to chip out the porous part and fill it with babbitt metal. This was bad enough, but inasmuch as it did not introduce an element of danger to life, it does not deserve the same condemnation that the dangerous fly wheel merits, but an honest man would not allow either defect to be covered up until he received pay for the engine, choosing to throw out the defective parts and substitute better ones.

Some engine builders find it almost impossible to design valves for their engines without using several small parts, which require careful adjustment, wear rapidly, break on every convenient occasion and drop into the steam ports, causing some part of the gear to be bent or broken. Some of these extra fixtures are necessary for the kind of valve used, but others are not needed, which is demonstrated by some intelligent engineer who proceeds to remove and throw them into the scrapheap. Every valve for a steam engine should be made as plain and simple as possible in order to prove durable and satisfactory.

When a cast iron weight is put on the lever of a back pressure valve it looks harmless, but in many cases the leverage is great enough to increase the total back pressure on the piston until it seriously interferes with the operation of the engine on account of the great increase in load. Suppose that enough weight is added to increase the back pressure 4 pounds on a 20 inch engine. The area of piston is 314 square inches, making the total back pressure 1,256 pounds, which is quite a load in itself, and in some cases at least is entirely unnecessary.

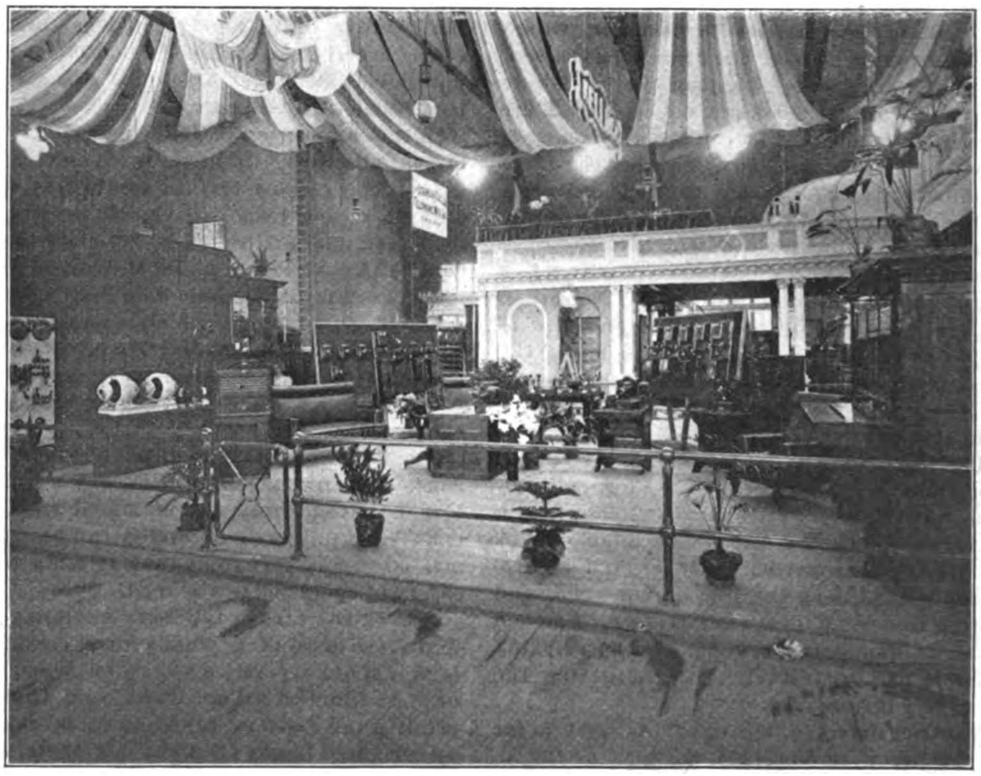

FIG. 1.—PAN-AMERICAN EXPOSITION EXHIBITS.

Stromberg-Carlson Telephone Exhibit in foreground. The Kellogg Switchboard Pavilion in the background.

A sole object in adding a condenser to a steam engine, is to reduce the back pressure, consequently it reduces the total load on the engine, therefore the cost of fuel is less as a natural consequence. The statement is frequently made to the effect that when a condenser is added it makes the engine develop more power, which certainly is a poor way of stating the case to say the least, as it is not logical.

The greater the resistance encountered by the piston, the more fuel is required, everything else being equal, and it follows as a matter of course that when the resistance is decreased the fuel burned is less. The total load on the piston may be considered under three heads, namely, the force required to turn the crank, the back pressure indicated by the gauge and the resistance of the atmosphere. If the latter is reduced the total load is less.

What appears like a contradiction of the foregoing is found in the following incident. One of the tenants in a certain factory moved out, and as the rooms were not rented again the manager expected that the fuel bill for the following month, would be lower as less power was used, but it was not.

There are several ways to explain this, but it was probably due to the fact that an automatic engine was used and the full load on it was not enough to be economical. When it was made less the cut off became shorter, hence the cylinder condensation increased enough to balance the decrease in load. As the resistance decreased the fuel burned would be less, provided everything else was equal, but it was not, because the cylinder condensation increased.

The boiler in a certain small plant was taken out and replaced by a larger one, but no change was made in the stack.

The draft was none too strong before the change was made, but it was weaker afterward, as the new grate was larger than the old one, hence the air came up through it more slowly, for the old stack would handle no more than it did before. The grate surface was reduced by laying bricks along the side and across the rear next to the bridge-wall, and this was a great improvement, as fuel could be burned at the same rate per square foot that it was under the old boiler.

Where the temperature of the gases as they escape to the chimney is high, it represents a loss in fuel, because more of this heat should enter the water and produce steam, but we cannot be sure that a low temperature of these gases represents the best possible practice, unless we know what causes the low temperature.

If the heating and the grate surfaces are correctly proportioned so much of the heat will be absorbed by the water in the boiler that there will not be much left to go up chimney. If on the other hand cold air leaks in through numerous holes in the brick setting it will reduce the temperature of the gases without improving the unsatisfactory results shown by a high chimney temperature.

With locomotive, vertical and other internally fired boilers this fault is eliminated, but if the draft is strong and the fire thin so that holes frequently appear in the fire, the cold air will be drawn up through them and thus reduce the temperature without improving the economy. As a rule the engineer in charge of a plant finds that certain important things cannot be changed at will, although he knows that better results would be secured if he could make changes in accordance with knowledge gained by experience in that place, but he can make minor changes at pleasure. For illustration, he cannot throw out his battery of tubular boilers and put in the locomotive type, but he can do away with holes in the brick setting which admit air where it is not wanted. If he has locomotive boilers, he cannot enlarge the grate surface, but he can make it smaller.

If either of these boilers are fitted with domes he cannot very well have them removed, especially if large holes have been cut in the shells under them, but he can make good use of non-conducting pipe covering to prevent radiation of heat. If he has 5 inch flues in his boilers, but prefers 3 inch tubes, he cannot make the desired change, but he can keep the flues free from an excessive amount of soot and fine ashes.

All of this shows us that an engineer who is determined to make the best record possible with the tools furnished him, will secure better results than one who is so thoroughly imbued with the idea that he could design a better plant, that he fails to make the best use of the machinery that is in his charge.

Black smoke pours out of some chimneys in this vicinity, while others are almost entirely free from it, and as the prevention of smoke is desirable on account of cleanliness and economy, a few suggestions along this line will be of interest, although it does not necessarily follow that suppressing the smoke nuisance always results in economy of fuel. If flames from coal in the furnace are brought into direct contact with the boiler, smoke is sure to result, therefore some means must be provided for completing combustion before the shell or the crown sheet is reached. The surest way to do this is to provide an extra furnace for distilling gas from the bituminous coal, which is then burned under the boilers. As it is impossible to produce smoke by burning gas in this way, the shell and tubes are not quickly covered with soot, which prevents heat from passing readily to the water, and this alone makes a saving worthy of consideration.

This extra furnace, which is called a gas producer, consists of a fire-bed several feet deep, operating under forced draft, which does not cause coal to be burned in the ordinary way, because there is not air enough admitted to accomplish this, but the volatile matter passes off from the top in the form of gas, while the coke which is thus formed slowly burns downward. Such a furnace occupies a considerable space, but is not very costly, therefore it may be considered a paying investment.

A due consideration of the foregoing shows that if only an ordinary furnace is supplied, it should be deep enough to allow combustion to take place before the flame touches the comparatively cool metal of the boiler, and this calls for at least 30 inches between grate and crown sheet.

It also shows that if coal is fired in front, causing the gases to pass over the burning coal already in the furnace, there will be a greater probability of complete combustion than if it is thrown in large quantities into the back part of the furnace.

A soft coal fire should be at least 8 inches thick, but the coal should be supplied in small quantities, and if no provision has been made for admitting air to the top of the fire, the fireman may leave the furnace door open for a few minutes after firing.

In this connection I wish to call attention to the fact that forced draft does not necessarily mean that a large quantity of air is forced into the furnace, for while the quantity required may not be large, it may be necessary to force it in by a steam jet or a fan, in order to get it where it is needed.

SOME PAN-AMERICAN EXHIBITS.

BY FRANK C. PERKINS

The success of the Pan-American is assured, not only from the artistic point of view as well as from the electrical standpoint, but also financially. The electrical effects are acknowledged to be superior to anything heretofore attempted in electrical decoration for buildings, while the exhibits, though not as large, are of a very high order and of great interest.

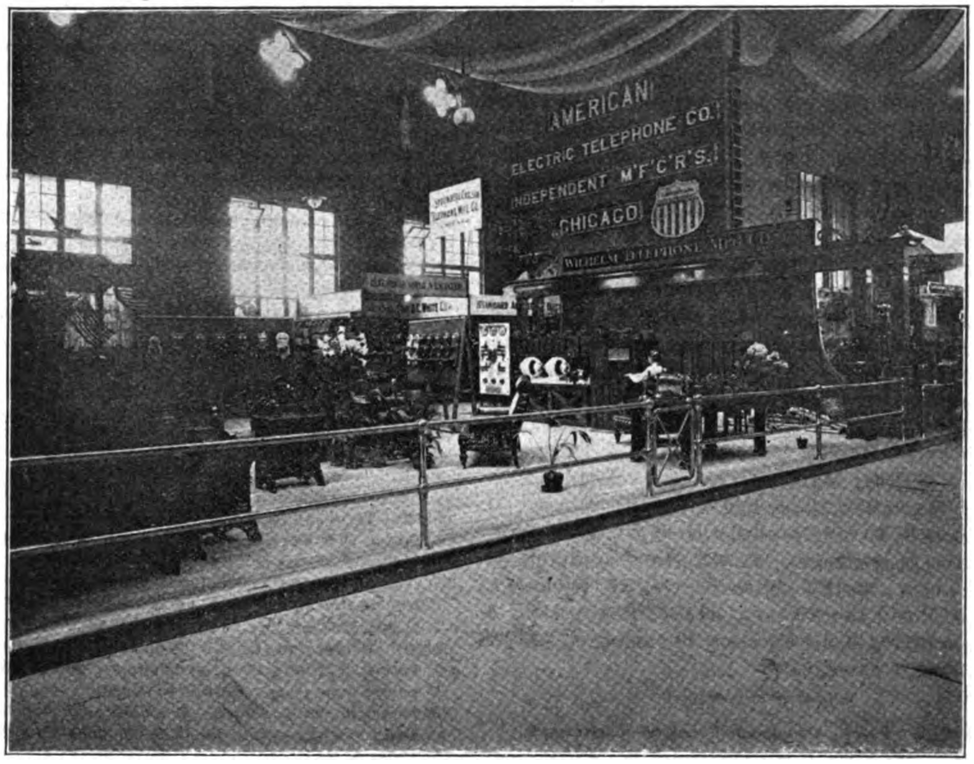

FIG. 2.—PAN AMERICAN EXPOSITION EXHIBITS.

Stromberg-Carlson Telephone Exhibit in foreground. Wilhelm Telephone Mfg. Company's Exhibit and the American Electric Telephone Company's Sign in backround.

Occupying a position near the front entrance to the Electricity Building is a very complete exhibit by the Stromberg-Carlson Telephone Manufacturing Company of its "Central Energy System for Telephone Exchanges." This exhibit is seen in the foreground in illustrations, Figs. 1 and 2, while in the background of the former may be noted the pavilion of the Kellogg exhibit, and in the background of the latter the exhibit of the Wilhelm Telephone Manufacturing Company, and the illuminated sign of the American Electric Telephone Company.

The Stromberg-Carlson system is installed throughout the grounds and buildings and the central switchboard of the Exposition is in active operation continuously as a part of the exhibit, the board being of the "light system type." It is a neat cabinet construction, and is continually attracting attention and intelligent inquiries, which are always courteously answered by Mr. Frank N. Barhydt, the company's representative in charge.

In connection with this central exchange are exhibited a twenty-cell 40-volt storage battery with a motor-generator set, and a tasteful single-panel marble switchboard for operating the same.

The exhibit includes two large multiple distributing boards of the "light system" variety, one of 3,600 line capacity, and the other of 9,600 line capacity; a hundred line "drop system" board, and a combination "light" and "drop" system cabinet of 100 line capacity.

Two revolving eight panel show boards, displaying this company's wall 'phones of many varieties and designs, are seen, including its intercommunicating type. The exhibit also includes several specimens of telephone booths and desk cabinet 'phones, lightning arresters, and a large line of telephone sundries. Comfortable settees and chairs are provided, and numerous electric fans in constant operation add to the comfort of visitors, and all readers of ELECTRICITY are invited when visiting the Exposition to the exhibit of the Stromberg-Carlson Telephone Manufacturing Company.

The International Navigation Congress.

The next International Navigation Congress will be held at Dusseldorf, Germany, June 29 to July 6, 1902. Information regarding it has been received at the State Department at Washington from Richard Guenther, the United States Consul General at Frankfort-on-the-Main. There will be two sections, one for inland, the other for ocean navigation. In the former the following will be discussed: Hoisting machinery, coal transportation on canals, dams, mechanical starting of vessels, the utilization of water power of locks for generating electricity. In the section for ocean transportation discussion will touch on the use of lighter ships on the seas, the construction and maintenance of dry and repair docks, and the construction and cost of dredging machinery.

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Street Railway Accountants' Association.

The fifth annual convention of the Street Railway Accountants' Association was held conjointly with that of the American Street Railway Association. An interesting programme was carried out and the following officers were elected: President, H. C. Mackay of Milwaukee, Wis.; first vice-president, C. L. Stingley of Philadelphia; second vice-president, W. B. Longyear of Brooklyn; third vice-president, S. C. Cooper of Cincinnati; secretary, W. B. Brockway of New Orleans; executive committee: W. F. Ham of Washington, F. R. Henry of St. Louis, Irwin Fullerton of Detroit and D. D. Bartlett of Boston.

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Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended October 9:

Alexandria, 5 cases, $120; Antwerp, 18 cases, $689; Argentine Republic, 38 cases, $245; Athens, 1 case, $100; Australia, 54 cases, $1,292; Azores, 2 packages, $109; Bilbao, 1 case, $50; Brazil, 224 packages, $16,272; British West Indies, 18 packages, $479; Chili, 23 packages, $1,255; Christiania, 1 package, $33; Constantinople, 1 package, $50; Cuba, 113 cases, $3,649; Glasgow, 1 package, $11; Hamburg, 105 cases $5,901; Havre, 18 cases, $650; Leeds, 1 case, $44; Liverpool, 125 cases, $3,609; London, 137 packages, $21,041; Manchester, 123 packages, $22,341; Marseilles, 4 packages, $1,450; Mexico, 71 packages, $8,818; Naples, 9 packages, $600; Newcastle, 21 packages, $5,300; Newfoundland, 45 packages, $2,122; Nova Scotia, 31 packages, $439; Peru, 43 packages, $1,637; Rotterdam, 3 cases, $110; Southampton, 18 packages, $2,012; Trieste, 5 cases, $340.

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New York Central Tunnel Contract.

THE New York Central will shortly let the contracts for the contemplated tunnel improvements. The cost will be about $250,000 for the first ten blocks. Work is to commence early in November and is to be completed by spring.

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INCORPORATIONS.

The Burnham Electric Light, Heat & Power Company, Lewiston, Pa. Capital stock $1,000.

The Remy Electric Company, Anderson, Ind. Capital stock $10,000. Directors: B. P., Frank I. and B. M. Remy.

The Chickasha Electric Company, Chickasha, I. T.—to operate an electric plant for both lighting and power, also a telephone exchange.

The Mohawk Valley Power Company, Gloversville, N. Y.—to sell electric power in all the counties along the Mohawk Valley. Capital stock $5,000.

The Delaware Construction & Engineering Company, Wilmington, Del—to build and operate railroads, telephones, canals, waterworks and other improvements.

The Illinois River Railway, Light & Power Company, Ottawa, Ill. Capital stock, $2,000,000. Incorporators: Josiah Cratty, William H. Duval and Edward J. Hamel.

The United States Electric Clock Company, New York City. Capital stock, $500,000. Directors: M. W. Townsend, Joseph Dellafield and E. A. Siegel, all of New York City.

The Mortimer Electric Company, New York City. Capital stock $10,000. Directors: Charles Mortimer, Jr., and G. P. Heinrich, of Brooklyn, and A. N. Clark, of South Norwalk, Conn.

The Electric Gas and Fuel Company, Kittery, Me.—to deal in gas and electricity for power, light and heating purposes. Capital stock $300,000. Officers: President, Horace Mitchell of Kittery; treasurer, William H. Cowan of Boston.

The Poughkeepsie Light, Heat & Power Company, Albany, N. Y.—to manufacture gas and electricity. Capital stock, $500,000. Directors: William V. Goodwin, Moses Ely and Thomas Kearny, of New York City, and L. Hollingsworth Wood and G. T. Kirby, of Mount Kisco.

The Hartford Construction Company, Hartford, Conn.—to construct, improve and equip electric, steam and other railroads and buildings and structures appertaining thereto, and to deal in electrical and other supplies and machinery. Capital stock, $500,000. Incorporators: Lucius F. Robinson, John T. Robinson and M. Toscan Bennett.

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ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCT. 8, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

683,927. Trolley-Switching Device. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel Company of Pennsylvania. Filed Dec. 3, 1900.

684,122. Trolley. George H. Spafford, Baltimore, Md. Filed March 18, 1901.

684,133. Electric Trolley Construction. Edward G. Thomas, Cambridge, Mass. Filed April 18, 1901.

684,136. Trolley-Wheel Support. Charles Tochterman, Brooklyn, N. Y., assignor of two fifths to Henry Weiler and Charles S. Hirsch, New York City. Filed March 8, 1901.

684,373. Trolley-Guard. Roy Inglis and Eugene Wilks, Jersey City, N. J., the New Jersey Title Guarantee & Trust Company administrator of said Inglis, deceased. Filed Aug. 3, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

683,981. Manufacture of Incandescent Mantles, etc. Achille M. Plaissetty, Paris, France. Filed Feb. 9, 1899.

683,982. Incandescent-Lamp Attachment. George D. Pogue, St. Louis, Mo. Filed April 29, 1901.

684,083. Self Regulating System for Electric Light and Power. Morris Moskowitz, Brooklyn, N. Y., assignor, by direct and mesne assignments, to James H. Young, trustee, same place. Filed March 16, 1901.

684,092. Terminal for Electric-Lamp Glowers. Henry N. Potter, Gottingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Filed Aug. 9, 1899.

684,093. Heater for Electric-Lamp Glowers. Henry N. Potter, Gottingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Filed Aug. 14, 1899.

684,094. Heater Cut-Out for Electric Lamps. Henry N. Potter, Pittsburg, Pa., assignor to George Westinghouse, same place. Filed Feb. 14, 1901.

684,166-684,167-684,168-684,169. Regulating Device for Arc-Lamp Circuits. Malcolm H. Baker, New York City and Newark, N. J., assignor to the Manhattan General Construction Company of New York. Filed March 12, 1900, March 21, 1900 (Renewed March 9, 1901), March 23, 1901.

684,222. Terminal for Electric Lamp Glowers. Frederick M. Goddard, Pittsburg, Pa., assignor to George Westinghouse, same place. Filed July 20, 1899.

684,229. Glower for Incandescent Lamps. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, same place. Filed March 24, 1899.

684,230. Glower Terminal for Electric Incandescent Lamps. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, same place. Original application filed April 22, 1899. Divided and this application filed Sept. 27, 1899.

684,340-684,341-684,342. Regulating Device for Arc Lamp Circuits. Malcolm H. Baker, New York City, assignor to the Manhattan General Construction Company, same place. Original application filed Sept. 5, 1899. Divided and these applications filed March 21, 1900, May 11, 1900, March 12, 1900. Renewed March 9, 1901.

684,378. Electric Lamp. Henry N. Potter, Pittsburg, Pa., assignor to George Westinghouse, same place. Filed Feb. 14, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

683,926. Motor Construction. George H. Hill, Glenridge, N. J., assignor to the Sprague Electric Company, New York City. Filed Aug. 5, 1901.

683,968. Driving Connection for Motors. Morris Moskowitz, Brooklyn, N. Y., assignor to James H. Young, trustee, New York City. Filed Oct. 26, 1900.

684,114. Switch for Electric Conductors. Theodore B. Shaffer, Westmoor, Pa., assignor of one-half to John Mainwaring, Plymouth, Pa. Filed July 23, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

683,952-683,953-683,954. Telephone Transformer. Hans Liebreich, Detroit, Mich., assignor to Frederick Rohnert, same place. Filed Nov. 30, 1900.

683,969. Telephone-Exchange System. William E. McCormick, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company. Filed Dec. 6, 1899.

684,111. Telephone Exchange System. Charles E. Scribner and James L. McQuarrie, Chicago, Ill., assignors to the Western Electric Company, same place. Filed Jan. 29, 1900.

684,194. Signal for Telephone Trunk-Lines. Henry M. Crane, New York City, assignor to the Western Electric Company, Chicago, Ill. Filed Feb. 25, 1901.

684,202. Lock-Out Device for Telephone Systems. Alfred Durbin, McConnellsville, O., assignor, by mesne assignments, to the United States Electric Manufacturing Company, Butler, Pa. Filed Feb 13, 1901.

684,274. Automatic Lighting-System for Telephone Stations. Frederick E. Lister, Minneapolis, Minn. Filed Jan. 14, 1901.

684,289. Signal for Telephone Switching Systems. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Filed Jan. 26, 1899.

684,308. Electric Telephone System. William E. Pembleton, Wittenberg, Wis. Filed Jan. 18, 1901.

684,315-684,316. Multiple Switchboard System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Oct. 19, 1891, Feb. 11, 1892.

684,317. Telephone-Exchange Apparatus. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed March 24, 1890. Renewed May 9, 1893.

684,366. Telephone Exchange Apparatus and Circuit. Georg Grabe, Deutsch-Wilmersdorf, and Lipa Polinkowsky, Berlin, Germany, assignors to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Filed May 25, 1901.

MISCELLANEOUS.

683,924. Electric-Elevator System. Ethelbert M. Fraser, San Francisco, Cal., assignor, by mesne assignments, to the Otis Elevator Company of New Jersey. Filed July 20, 1899.

683,958. Sound Record. Thomas H. Macdonald, Bridgeport, Conn., assignor to the American Graphophone Company of West Virginia. Filed Aug. 23, 1898.

683,977. Motor-Vehicle. Alexander Palmros, Columbus, Ohio, assignor to Joseph A. Jeffrey, same place. Filed Aug. 1, 1900.

684,007. Circuit Protector. Alfred Stromberg, Chicago, Ill. Filed Oct. 11, 1900.

684,014. Coin Actuated Medical Battery. Nelson M. Watson, Detroit, Mich. Filed Jan. 28, 1901.

684,044. Composite Telegraph or Other Pole or Post. Frederick W. Commons, Ballarat, Victoria. Filed Feb. 19, 1901.

684,049. Plate-Separating Device for Electrolytic Tanks. Elmer G. Elliott and Valentine Kishner, Perth Amboy, N. J. Filed Dec. 24, 1900.

684,165. Method of Regulating Electric Circuits. Malcolm H. Baker, New York City, assignor to the Manhattan General Construction Company of New York. Filed Sept. 5, 1899.

684,204, 684,205. Reversible Galvanic Battery. Thomas A. Edison, Llewellyn Park, N. J. Filed Oct. 31, 1900, June 20, 1901.

684,225. Electromedical Device. George Graybill, York, Pa. Filed March 6, 1901.

684,255. Electric-Cable Hanger. George W. Hughes, Philadelphia, Pa. Filed Aug. 24, 1901.

684,259. Electrical Apparatus for Body Wear. Joseph Kornitzer, Socorro, N. M. Filed Aug. 12, 1901.

684,291. Cathode-Plate. William A. McCoy, Perth Amboy, N. J. Filed Sept. 14, 1900.

684,296. Electric Furnace. Walther Nernst, Gottingen, and Ludwig Glaser, Coburg, Germany. Filed July 6, 1900.

684,326. Vacuum-Electrode for Therapeutic Purposes. Reinhold H. Wappler, New York City. Filed March 5, 1901.

684,338. System of Electrical Distribution. Henry J. Gille, St. Paul, Minn., assignor of one-half to General Incandescent Arc Light Company, New York City. Filed Nov. 15, 1900.

684,339. Electropneumatic Action. John T. Austin, Detroit, Mich. Filed July 22, 1899.

684,351. Electrotherapeutic Instrument. Albert W. Courtney and John S. Mead, Buffalo, N. Y.; said Mead assignor to said Courtney. Filed Dec. 19, 1900.

684,370. Phonograph. Henry J. Hagen and George McIntosh, Newark, N.J., assignors to Joseph Newcomb Blackman, East Orange, N. J. Filed Nov. 16, 1900.

684,371. Motor-Vehicle. Arthur A. Hammerschlag, New York City. Filed March 13, 1900.

684,376. Storage Battery. Levi W. Lombard, Boston, Mass. Filed Nov. 15, 1900.

THE TELEPHONE WORLD.

Reorganization of the Telegraph, Telephone & Cable Company of America.

The reorganization of the board of directors of the Telegraph, Telephone & Cable Company of America is now in progress, says the New York "Commercial" of October 9. The number of these officials will probably be reduced from 21 to 9. An official of the company said there will also be a shake-up in the executive offices of the company and several minor officials retired. As now contemplated President Thomas will be retained.

The reorganization of the company is being directed by Charles W. Morse, who controls about seven-eighths of the stock. It is his intention to thoroughly reorganize the company in all departments. The announcement of the new board of directors and other official changes, it was stated, will not be made until next week.

Mr. Morse in speaking of the telephone situation, said:

"I wish to say once for all so that the matter may rest, that the Telegraph, Telephone & Cable Company of America has but one object, and that is to compete with the Bell. The company is absolutely independent, and is not backed by either of the telegraph companies. The system will be built up in all sections of the country, and in a few years will be able to give a service that will meet every demand. All of the independent lines will be merged, and new communications established. The independent company is in the field to stay and will naturally push forward."

The Cowanshannock Independent Telephone Company is now a household necessity in Armstrong County, Pa. It is organized on a mutual basis, and already 30 miles of line are in operation. The line connects with the Bell line at Kittanning, and in this way the rural resident can reach any part of the country as well as his city brother. The company rents no telephones except to hotels. To get the 'phone in his residence a man must take at least one share of stock, which sells at $10, and pay for his own telephone instrument and also for having the wires put in. Then he can talk as often as he pleases, except when he talks over the Bell lines, when he must pay their regular toll rates from Kittanning. Already $1,500 of the stock has been taken up, and the balance will be taken as fast as the lines can be extended. As many families as possible are put on one line, to do away with the necessity of switchboards. Each family has a separate ring, and they can call one another without going through a central. Moreover, to give the 'phones greater power by lessening the distance, the company has divided the line into three sections, by inserting two switches, one at Rural Valley and the other at Smeltzer. Another section of line will shortly be completed, and will be connected by a switch at Whitesburg. The company is authorized to operate in Armstrong, Indiana and Westmoreland Counties. It was organized at first simply for the benefit of a few, but it has been meeting with such success that the lines will be extended as fast as possible, and it expects to have the farming districts of all three counties connected by telephone within the next year.

The Interstate Telephone Company, which has acquired by purchase many local telephone companies in Pennsylvania and New Jersey, and which a short time ago bought the Elizabeth, N. J., Mutual Telephone Company for $30,000, met last week in Elizabeth and organized. W. H. Rankin, president of the old company, resigned and Hugh Hammell of Trenton was elected president, and Barker Gummere, Jr., also of Trenton, was elected treasurer. The following were elected directors: Hamilton F. Kean, Barker Gummere, Jr., Henry Loudenslager, William S. Hancock, P. H. Gilhooley, John W. Whalen and Lawrence O'Donnell. The company has decided to spend $100,000 in making over the system.

The Rawson Company has incorporated a company known as the Seneca Falls, N. Y., Home Telephone Company, with a capital of $100,000, to operate in Seneca Falls, Tyre and Junius, Seneca County. The directors are: Howard Hendrickson, of Albany; A. G. Lord, J. A. Drake, S. R. Rawson, F. H. Sudro, T. M. Brush, F. W. Martin and J. H. Griswold, of Elyria, O.

A cable to connect the Diamond State Telephone Company's lines, on the eastern shore of Maryland, with Baltimore was laid last week. The cable crosses the Chesapeake Bay from Kent Island to Sandy Point, a distance of five miles.

The Citizens' Telephone Company of Grand Rapids, Mich., has taken control of the independent exchange at Battle Creek in that State.

The Northwestern Telephone Company is extending its line from St. Croix Falls to Centuria, Wis., the new town on the extension of the "Soo" line.

To Plan a Long Distance Underground Telephone Line.

The purpose of the Pennsylvania Subway Company, chartered last week at Harrisburg, Pa., is to further the plans of the United Telephone & Telegraph Company for the control of a long-distance telephone service in that State, which will compete will the Bell Telephone Company, and along this line, to furnish a system of conduits in the principal cities, from Buffalo to Washington, for the use of the electric telegraph and telephone companies. As a part of the United Telephone & Telegraph Company's plan to control a system in Pennsylvania and other States, the Cumberland Valley Telephone Company, with a right of way from Harrisburg to the District of Columbia, was recently organized, with a capital of $500,000.

A contract was lately signed by James T. Doyle for the Pittsburg & Allegheny, Pa., Telephone Company with the Union Telephone & Telegraph Company for an interchange of long-distance service. It opens up to Pittsburg territory not hitherto covered. The towns included are Erie, Meadville, New Castle, Mercer, Clarion, Franklin, Warren, Petroleum Center, Ellwood City, Sharon, Tionesta, Conneaut Harbor, Shenango and other important points. The two companies will meet at a point on the dividing line between Lawrence and Beaver Counties, about one mile from the Beaver River. The Union Telephone & Telegraph Company now comes as far south as Hoytdale, and the Pittsburg & Allegheny as far north as New Castle. The Pittsburg & Allegheny will begin the construction of a line from the latter point to the dividing line between Lawrence and Beaver Counties, and at the same time the Union Telephone Company will commence building south from Hoytdale. The officials of the company believe that they will be able to finish the construction by December 1, and have the line in operation on that date.

A report from Salt Lake City, Utah, says that Samuel F. Fenton, P. W. Madsen and others have purchased the interest of E. W. Hammer, whose application for a franchise for an independent telephone system is now before the law committee of the city council. Not only this, but the new owners of the interest in question say they are backed by ample capital, and the promise is made that if the franchise is granted that the company will at once commence the construction of the line.

The Cumberland Telephone & Telegraph Company, which recently acquired the property of the McMinnville, Tenn., Telephone Company, has a large corps of laborers at work there putting in new poles, wires, lines and boxes and will put in an up-to-date and more commodious switchboard. The entire system will be renovated and improved.

At a recent meeting of representatives of the Hampton Telephone Company and the Southern States Telephone Company it was decided to lay a new telephone cable between Norfolk and Hampton, Va. This new cable will, it is said, greatly improve the service, which has not been of the best at any time, and often it is entirely out of working order.

A controlling interest in the Worcester Telephone Company of Snow Hill, Md., has been purchased by parties representing the Eastern Shore Telephone Company, of which Harry A. Richardson, of Dover, is president. The object of the company is said to put the whole Eastern Shore under one system with long-distance service.

The Home Telephone Company, Omaha, Neb., organized some two months ago with a capital stock of $50,000, has begun its erection of poles and the system will shortly be in running order. I. D. Clarke has been made president; C. F. Calhoun, secretary-treasurer, and J. M. Elwell, director.

The Wisconsin Telephone Company has decided to extend its system as far west as Franksville. A sufficient number of farmers in Caledonia subscribed to make the improvement advisable.

The Zanesville, O., Telephone & Telegraph Company, has increased its capital stock from $200,000 to $250,000.

The independent anti-Bell 'phone line from Duluth and Superior to Minneapolis and St, Paul, Minn., will be ready for use next spring.

The Roswell, N. M., Telephone Company is putting up some heavy poles, and when the wires are replaced the service will be much improved.

Stanberry, Mo., is to have a new telephone exchange.

Loud Speaking Telephones for Ships.

One of the most important instruments on modern vessels is the so called loud-talking telephone. Experiments have recently been made with it in the German Navy, and have proved so satisfactory that instruments are now being placed on most of the large seagoing ships. The special value of this telephone lies in the fact that a captain standing on the bridge can easily hear any words that may be spoken to him from the interior of the vessel, even though a violent storm may be raging at the time, and can in turn transmit without straining his voice his own orders to officers or men in any part of the vessel.

Bad accidents have occurred through a misunderstanding of orders given at a critical moment, due to the fact that the words were not distinctly heard, and it is only reasonable to assume that casualties of this kind can be avoided in the future through the use of this loud talking telephone. Such, at least, is the opinion of naval experts in Germany.

The Kentucky Telephone Association met at Owensboro the first of the month, with a large representation of the different independent companies of Kentucky and Southern Indiana. Col. J. D. Powers delivered the address of welcome, and President H. V. Bishop, the response. D. L. Pendleton, of Winchester, delivered an address upon "Litigation and Legislation," and W. C. Polk, engineer of the Home Telephone Company of Louisville, an address upon the subject of "Telephone Construction." The following officers were elected: H. V. Bishop, of Cynthiana, president; H. K. Cole, Owensboro, vice president; James Maret, Mt. Sterling, secretary and treasurer. The next place of meeting was left with the executive committee.

The work of installing the new Stromberg-Carlson system in the the telephone department of the Milwaukee, Wis., Electric Railway & Light Company is approaching completion, and it will be in full operation on or before October 25. The new switchboards are in place and have a capacity of 1,200 'phones, but owing to the many improvements and extensions being made on the suburban lines at the present time, only 120 will be placed in actual service. Telephone stations are now being placed at all of the principal downtown crossings of the line as well as in the suburbs. The company's system now embraces 200 miles of circuit, and is worth about $50,000.

The Western Electric Company is installing in the local telephone office at Hartford, Conn., a modern telephone switchboard, which will be ready for use in about a month. Manager French, of the Southern New England Telephone Company, said lately that he expected to make the necessary connections without any delay in the service. A switchboard of a similar pattern has been in use in the Waterbury office of the company for the past two years and has proved a success. One of the advantages of the switchboard will be that the lifting of the transmitter from the hook will establish the connection with central, and it will not be necessary to ring the bell to call the local office.

The Twin City Telephone Company and La Crosse Telephone Company will build a line between La Crosse, Wis., and Minneapolis, Minn. President Moulton, of the Minneapolis Company, conferred with President Lohmiller of the La Crosse Company, and it is announced that a line would be started at once. The line will connect with several independent telephone lines between the two cities and will have direct service with Northern Wisconsin points.

The Cumberland Telephone Company of Rockwood, Tenn., has purchased the local exchange of the Roane County Telephone Company.

The Bell Telephone Company has adopted the conduit plan for burying its wires in Windsor. Ont.

TELEPHONE INCORPORATIONS.

The Citizens' Telephone Company, Batavia, O. Capital stock, $50,000.

The Indianapolis Telephone & Telegraph Company, Sherman, Tex. Capital stock, $200,000.

The Brookville Telephone Company, Brookville, O. Capital stock, $6,000. Incorporators: O. E. Baker, N. W. Rinehart, J. C. Snyder, Enos Shellabarger and W. Z. Miller.

The Lewiston Automatic Telephone Company, Lewiston, Ill. Capital stock, $2,000. Incorporators: George F. Loar, Ralph Hanson and Lucien Gray.

The Bismarck Telephone & Electric Company, Bismarck, N. D.—to operate telephones and an electric lighting plant, New Jersey office, 854 Broad street, Newark; authorized capitalization $100,000.

GENERAL ELECTRICAL NEWS.

Lighting.

Alvin, Tex.—R. B. Lacy has organized an electric light company, and as soon as a franchise can be procured from the city he will go right to work putting in the plant.

Atkinson, Ill.—This place is to have an electric light plant.

Caldwell, O.—The proposition to issue $5,000 electric light bonds was recently carried.

Crawford, Ill.—Frank Bartmas of this city has been selected to superintend the construction and placing of an electric light plant at Altamont, Ill.

Delmar, Del.—This place is to have electric lights.

Demorest, Ga.—J.S. Adams & Son want prices on an electric light plant.

Doylestown, Pa.—A special meeting of the Electric Light Company was lately held at the office of Henry Lear, for the discussion of important matters relating to the better equipment of the plant.

Elmwood, Ill.—The electric light plant recently destroyed by fire will be rebuilt at once.

Escanaba, Mich.—The city electric lighting plant has become taxed to its utmost capacity, and, as a consequence, no additional electric lights can be furnished until the plant is increased in power.

Findlay, O.—Adams' Brothers Company will erect a finely equipped electric light plant.

Galion, O.—A resolution was passed at the recent city council meeting accepting the contract between the city and F. L. Byrd for the improvement of the electric light plant at a cost of $980.

Greensboro, N. C.—The Greensboro Electric Light & Gas Company is preparing to install a plant for furnishing incandescent lights and electric power.

Hamlet, N. C.—G. O. Saunders of Southern Pines will install an electric light plant and probably a system of waterworks.

Hubbard, O.—The citizens will again be called upon to vote at a special election, November 5, upon the proposition of issuing $8,000 of bonds for the proposed electric light plant, as the former election was declared illegal.

Knoxville, Tenn.—The Proctor Furniture Manufacturing Company, of which J. C. Sterch is manager, will install an electric plant for lighting purposes.

Mascoutah, Ill.—The electric light question is coming up in the city council and will soon be voted on.

Odell, Ill.—An electric light plant is to be installed here.

Parsons, Pa.—The electric light plant at this place is being doubled in capacity.

Scottsburg, Ky.—Members of the town board and citizens are in favor of establishing an electric light system.

Two Rivers, Wis.—Another special election will be necessary before the electric light and waterworks plant can be accepted by this city.

Wellington, Kan.—It is proposed to submit the question of issuing $15,000 electric light bonds to a vote of the people.

Woodstown, N. J.—A new proposition has been submitted to the borough council by the Ice & Cold Storage Company, agreeing to light the town with electricity by 80 incandescent lights for $1,200 per annum.

Street Railways.

Albany, N. Y.—The State Board of Railroad Commissioners have granted an application of the St. Lawrence International Electric Railroad & Land Company for authority to construct a road 7½ miles long between Alexandria Bay on the St. Lawrence River and Redwood on the Rome, Watertown & Ogdensburg Road.

Albion, Mich.—The old franchise for the electric road through here having become null and void by reason of time limitations, William A. Boland has applied for another franchise as a new representative of the company.

Baltimore, Md.—A plan to build another electric railway system in this city and suburbs is being promoted by the company termed the Maryland Railway Company, which has asked for a franchise from the city council.

Bloomsburg, Pa.—A company recently organized in this place will build an electric railway from Berwick to Nanticoke. The line will be 20 miles in length, and will pass through Beach Haven, Hurlocks, Hicks' Ferry and Shickshinny, connecting with the Wilkes-Barre Road at Nanticoke.

Cleburne, Tex.—Robert H. Cornell of St. Louis and Hon. W. S. Wortham of Paris have been looking over the city as a preliminary step to putting in a power house and electric street railway.

Corry, Pa.—A trolley road is to be built connecting this city with North East, passing through the towns of Findley Lake, the summer resort, Wattsburg and Cutting, a distance of 30 miles.

Dayton, O.—The Dayton, Covington & Piqua Traction Company, of which Dennis Dwyer is president, has increased its capital stock from $50,000 to $1,150,000.

Denver, Col.—It is now practically settled that the Colorado & Southern Railroad will install electricity as a motive power on all its suburban lines running out of this city.

Dundee, N. Y.—Franchises in favor of the proposed electric railroad from this village to the village of Bradford have been granted in the towns of Starkey, Barrington and Tyrone.

Evansville, Ind.—An electric railroad between this city and Princeton is projected by capitalists.

Gouverneur, N. Y.—At a recent meeting of the village board Charles McCarty made application for a franchise to construct and maintain in the village an electric railway, which was granted.

Hartford, Conn.—The Connecticut Railway & Lighting Company is purchasing land along the survey of its proposed road from Waterbury to Southington, and it is understood that the construction of the line will be undertaken early in the spring. At Southington connection will be made with the line which runs to Plainville, New Britain and this city, thus giving the company a continuous road from here to Waterbury. The company is gradually developing a trolley network that will cover all the populous communities of the central and southwestern part of the State.

Janesville, Wis.—An ordinance granting a franchise to P. L. Spooner, to construct and operate an electric road in this city, was recently passed by the council.

Nacogdoches, Tex.—C. C. Galloway & Co., a local corporation, has made application to the city council for a franchise for an electric street railroad, which includes a belt line of the principal streets of the city.

Parkville, Mo.—The granting of a franchise by Buchanan County Court to the Kansas City, Parkville & St. Joseph Electric Road has stimulated local interest and a franchise is confidently expected from Platte County Court at the November term.

Pensacola, Fla.—The Pensacola, Electric & Terminal Railway Company is again considering the use of trolley motors upon the steam dummy line to Fort Barrancas. W. H. Northrop is president of the company.

Plainfield, N. J.—The necessary signatures having been obtained for the right of way over the proposed trolley line from this city to South Plainfield, it is expected that the road will be constructed at once.

Princeton, N. J.—The town council is considering the application of a new trolley company for permission to run its tracks to the middle of the town opposite the main entrance to the college campus.

Quincy, Ill.—The Quincy & Southeastern Electric Railway Company, with a capital of $5,000, will operate electric railways, power, and light plants. Robert W. Gardner, Chauncey H. Castle and George Wells are interested.

Royer's Ford, Pa.—A charter has been granted to a number of capitalists of this place to operate a trolley line between here and Trappe.

San Juan, Cal.—The San Juan Railway & Electric Company has been incorporated by A. S. Monson, G. A. Taff, J. A. Barclay, W. R. Thurston and S. T. Hamilton, to operate in Ouray County, with a capital stock of $300,000.

Whittier, Cal.—The city council has ordered the advertising of the electric road franchise, the bids to be received up to November 11, and a bond of $5,000 to be filed by the successful builder as a guarantee that all provisions of the franchise will be carried out.

Manufacturing.

Ansonia, Conn.—The H. P. Cameron Electrical Manufacturing Company, which has been successfully operating in Syracuse, N. Y., recently removed to this place. Its output is assembled commutators and armature coils for all systems; solid sheet mica and segments, in addition to rewinding armatures and performing all kinds of repair work.

Dover, Del.—The Electric Fountain Company of America was incorporated here lately with a capital stock of $1,000,000, and with all Philadelphia incorporators. The concern is authorized to engage in the manufacture and operation of certain electrical devices and exhibition pieces under certain United States letters patent.

Syracuse, N. Y.—The contract for placing a dynamo of 50-kilowatt power in the L. C. Smith College of Applied Sciences, Syracuse University, has been awarded to the Onondago Dynamo Company.

Company Matters.

Boston, Mass.—At the annual meeting last week of the Edison Electric Illuminating Company of this city the board of directors was increased from nine to twelve members, and the directors were elected.

Menomonie, Wis.—The Submerged Electric Motor Company is enlarging its plant. Its business is increasing rapidly and more room is needed for the manufacture of motors.

Spokane, Wash.—The Wallace Manufacturing, Electric & Water Company has sold its plant and franchise to men of this city for the sum of $136,000. They have formed the Wallace Light & Water Company, to operate the property. The officers of the company are: F. F. Johnson, president; Robert E. Strayhorn, vice-president and manager; E. J. Dyer, secretary and treasurer.

Power and Transmission.

Linwood, Neb.—R. N. King, an engineering contractor of New York City, has projected a power scheme, which contemplates the development of 30,000 hp. on the Nebraska prairies. It is proposed to build a canal 30 miles in length from here on the Loup River to Fremont on the Platte River. This canal will carry the waters of the Loup River through a natural formation that lends itself readily to the work and empties into a reservoir on the Elm Creek canon at Fremont, Neb., where the bluffs rise 200 feet above the Platte River.

Winnipeg, Man.—The Winnipeg Street Railway Company and the Ogilvie Millin Company have formulated a co-operative plan whereby they will jointly construct an immense power plant for the transmission of electric power from the Winnipeg River to this city. The plant will cost in the neighborhood of $1,000,000.

Automobiles.

McKeesport, Pa.—The McKeesport Automobile Transfer Company has begun operations and will soon have four autos running to parts of the city the traction lines do not reach.

Milwaukee, Wis.—Ground has been broken for a new factory to be built by the Kunz Automobile Company.

New York City.—The Manhattan Automobile Storage & Repair Company of this city has been formed with a capital of $50,000. J. A. Scott and J. E. Donohue, New York City, and A. C. Bell, Brooklyn, are the directors.

Peoria, Ill.—Monroe Seiborling has succeeded in interesting Chicago capitalists in a project to establish an automobile factory in the building formerly used as a bicycle factory.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, October 14, 1901.

STREET RAILWAY STOCKS.

NAME.	Par	Last Sale.	
NEW YORK CITY.	value.	Bid.	Asked.
Bleeker Street and Fulton Ferry	100	35	37
Broadway and Seventh Avenue	100	245	249
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	156¾	160
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	117¼	117½
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	107	108
Brooklyn City Railway	100	243	244
Brooklyn Rapid Transit	100	60	60⅛
Baltimore United Railways, com	50	16½	16¾
do. do. do. pref	50	91	92
Buffalo Railway	100	110	111
Cleveland City Railway	100	122	122½
Cleveland Electric Railway	100	85	85¼
Columbus (O.) Street Railway	100	45	48
Jersey City, Hoboken and Paterson	100	20	23
New Orleans City Railway, com	100	28	30
do. do. do. do. pref	100	101	105
North Jersey Street Railway	100	22	23
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	30	34
do. do. do. pref	100	85	86
St. Louis United Railways, com	100	25¾	26
do. do. do. pref	100	79¾	80¼
United Electric of New Jersey	100	17½	20
PHILADELPHIA.			
American Railways	50	40¾	41
Citizens	50	359½	360
Columbus Railway	100	40	40¼
Columbus Railway, pref	100	84½	85
Consolidated Traction of New Jersey	100	66	67½
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23⅝	24
do do pref	50	62	62½
Dayton Traction	100	156	156½
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151½
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J	100	..	..
Philadelphia City, $23.75 paid	50	205	205½
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	95¾	96
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	27½	28
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	178½	179
West End Street, com	50	94	94¼
do. do. do. pref	50	112	113
CHICAGO.			
City Railway	100	202	203
Lake Street Elevated	100	11½	11¾
North Chicago	100	190	200
Union Traction, com	100	17½	18½
do. do. pref	100	58	60

STREET RAILWAY STOCKS.

NAME.	Par	Last Sale.	
PITTSBURG.	Value.	Bid.	Asked.
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23¾	24
do. do. do. pref	50	63¾	64
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	49	50

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par	Last Sale.	
NEW YORK CITY.	Value.	Bid.	Asked.
Electric Boat, com	100	20½	24
do do pref	100	43	49
Electric Lead Reduction	100	1½	2¼
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	1½	3
do do pref	100	3	5
General Carriage	100	¾	1
General Electric	100	256¼	256½
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	250	251
General Electric	100	256¼	256½
Massachusetts Electric Companies, com	100	36	36¼
" " " pref	100	92	92¼
Westinghouse Electric & Mfg., com	50	70½	72½
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	165	165¼
National Carbon, com	100	18	18¾
do do pref	100	83	85
PHILADELPHIA.			
Electric Company of America	50	6¾	7
Electric Storage Battery, com	100	63	68
do do do pref	100	63	68
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	5¼	5⅜
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	93	94
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par	Last Sale.	
BOSTON.	Value.	Bid.	Asked.
American Telephone & Telegraph Company	100	157¾	158
Erie Telegraph & Telephone Company	100	39	39½
New England Telephone Company		134¼	134½
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co	100	105	110
Commercial Cable Company	100	180	185
Franklin Telegraph Company	100	45	54
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	116	118
Mexican Telephone Company	100	2	2¼
New York & New Jersey Telephone Company	100	168	170
Pacific & Atlantic Telegraph	25	78	85
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		91¼	91⅜
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	116
Cumberland Telephone & Telegraph Co	50	136	140
Chesapeake & Potomac Telephone Company	100	60	65
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		75	76
Hudson River Telephone Company	100	110	115
Northwestern Telephone Company, guar	50	124	126
Providence (R. I) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Oct. 14.

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1	1¼
Eddy Electric Manufacturing Company	25	10	10¼
Storey General Electric	10	11	12
Consolidated Car Heating	100	55	57
Standard Underground Cable	100	218	220
Pratt and Whitney, pref	100	90	95

STREET RAILWAY BONDS.

	Last Sale.	Int. Paid.
ALBANY.		
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96¾	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅝@16¾c.; Lake, 16¾@17c.; casting, 16½@16¾c.

The Lorain Steel Company has secured the contract for constructing an underground electric railway in Wolverhampton, England.

Stockholders of four Cleveland traction companies have made the exchange into bonds and stocks of the Lake Shore Electric Railway.

The Edison Electric Illuminating Company of Boston has declared a regular quarterly dividend of 2½ per cent., payable November 1 to stockholders of record October 14.

The Worcester (Mass) Traction Company has voted to retire and cancel 19,600 shares of the preferred stock. The company recently sold its road to a syndicate, and will probably go out of business.

The Milwaukee Electric Railway & Light Company has declared a regular quarterly dividend of 1½ per cent. on its preferred stock, payable November 1. Books close October 21 and reopen November 2.

Stock of the Consolidated Traction Company of Pittsburg must be deposited for exchange into Philadelphia Company stock by November 1 with the Land Title Company of Philadelphia, or the City Trust Company in Pittsburg.

It is rumored in financial circles that the Metropolitan Street Railway Company of New York may shortly reduce its quarterly dividend from 1¾ per cent. to 1 per cent. It is impossible to obtain a confirmation of the rumor.

A dispatch from Denver, Col., states that a syndicate comprising mainly the officials of the General Electric Company is negotiating with the owners of the Denver Tramway Company for the purchase of its entire property on a basis of $8,500,000.

The Electric Express Company of Schenectady, N. Y., has been incorporated with a capital of $25,000, to transfer by means of electric and steam cars and other vehicles, goods, merchandise and wares, and to enter into contracts with transportation companies.

The Sprague Electric Company recently held its annual meeting and re-elected the following officers for the ensuing year: John Markle, president; Edward C. Platt, first vice president; Allan C. Bakewell, second vice president; Harry R. Swartz, secretary and treasurer.

The Philadelphia "Stockholder" says: When the Manhattan Elevated Railroad of New York is electrically equipped the stock may be worth many points more than at present, but at the current rate of progress it will be in the distant months before the steam locomotives disappear from the elevated.

The annual report of the Brooklyn Rapid Transit Company for the year ended June 30, 1901, has been made public. It shows: Gross, ,$12,135,559; expenses, $7,216,008; net, $4,919,551; taxes, $754,626; balance, $4,164,925; net fixed charges, $3,587,122; surplus, $577,803; previous surplus, $623,426; total surplus, $1,201,229.

According to advices from Boston, the Cambridge Electric Light Company will issue $50,000 new stock (500 shares) at $140 per share, the proceeds to be expended for additions to plant. Stockholders of the company are entitled to subscribe for one new share for each nine shares now held by them. Subscriptions will be received by the Mercantile Trust Company until October 25, when the right to subscribe will terminate.

It is announced that pursuant to an article of the mortgage given by the Electrical Vehicle Company and others to the Morton Trust Company, as trustee, that a general meeting of the owners of the bonds outstanding under this mortgage will be held at the office of the Morton Trust Company on November 16 for the purpose of the exercise by the bond owners of all or some of the powers conferred upon them by article 6 of the mortgage, if at the meeting the holders of the securities shall deem it wise to take such action.

Hon. Allen L. McDermott of New Jersey has been appointed receiver for the City and Suburban Railway Company, one of the companies comprising the Washington Traction & Electric Company, which controls all but one of the important street railway lines in the District of Columbia. The company favored the appointment of a receiver, but objection was made by representatives of the minority stockholders, who sought delay.

The Boston "News Bureau" says "it is believed that the General Electric Company will act in the matter of capital restoration this winter. Restoration of the capital reduction would mean a distribution of stock to the amount of 66⅔ per cent. of the present stock. On this basis the present price of the stock would mean a valuation of about 153 after distribution. It is understood that the company would continue 8 per cent. dividends. Earnings this year are at a rate sufficient to pay twice this amount on the increased stock."

The Connecticut Railway & Lighting Company reports for the eight months to August 31, 1901: Gross earnings, $1,033,115; operating expenses, $664,006; net earnings, 369,109; present interest charges, $284,323; balance, $84,786. The general balance sheet as of August 31 shows: Assets—Property, $22,463,037; plant and construction, $1,985,259; advance accounts, $27,398; cash, $146,790; accounts receivable, $63,6[illegible]5; materials, $78,714; total, $24,763,239. Liabilities—Preferred stock, $4,000,000; common stock, $11,000,000; bonded debt, $9,356,000; accrued interest, $72,409; accounts payable, $139,953; taxes accrued, not due, $47,233; rentals and advertising, $3,186; deposits, $1,455; unclaimed wages, $9; advance ticket sales, $2,239; accident insurance fund, $56,630; balance undivided profits, $84,124; total, $24,763,239.

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EDITORIAL NOTES.

An Important Institute Meeting.

An important meeting of the American Institute of Electrical Engineers will be held Friday evening, October 25, at 12 West 31st street, New York City.

The general subject of the meeting will be "Regulation in Prime Movers and Successful Operation of Alternators," with an introduction by President Steinmetz. The following papers will be presented: "Angular Variation in Steam Engines," by Mr. P. O. Keilholtz, of Baltimore. "Parallel Operation of Engine Driven Alternators," by Mr. W. L. R. Emmet, of Schenectady. "Parallel Running of Alternators," by Mr. Ernst J. Berg, of Schenectady. "Angular Velocity in Steam Engines, in Relation to Paralleling of Alternators," by Mr. Walter I. Shilcter, of Schenectady.

It is expected that other papers also specially prepared for this meeting will be presented, as many engineers in electrical, steam, gas and hydraulic interests have been invited.

As the above papers will be presented in abstract only, the secretary has requested us to announce that members who are especially interested in the subject are advised to send for advance copies, which will also be distributed at the meeting.

* * *

Behr's Mono-Rail.

In the issue of Electricity of March 29, 1899, and June 6, 1900, we referred at considerable length to a scheme which had been proposed of connecting Liverpool with Manchester in England by means of Behr's mono-rail electric railway. It seems that the scheme, according to the latest advices from Great Britain, has passed through various ordeals, but that even now there appears to be no great hurry to carry it out on the part of the authorities. We hear that the promoters hope to move in the matter "in the early spring!" that a new company will have to be floated, and that a new bill will require to be promoted with reference to an agreement with one of the affected municipalities. It is further "hoped" that a portion of the Warrington generating station may be completed by the spring of 1903, and one section of the line constructed, but it will be another two or three years before the bulk of the rolling stock will be ordered, and 1905 is spoken of as the probable date of journeying between Manchester and Liverpool by lightning express service. So much has been said about this project in England that most people really came to believe that something was actually being done to help in the direction of higher speed electric traction, but it appears that the German trials now proceeding are likely to be completed before practical operations in England are even begun.

* * *

An Alleged New System for Transmitting Signals.

Advices received from abroad by a daily paper state that a system of transmitting ether waves using the earth as a conductor has been tried with excellent results in Buckinghamshire, England. This system of wireless telegraphy, known as the Armorli system, is the invention, so it is claimed, of a young Swede by the name of Orling.

Experiments carried out on October 17 before a number of people are said to have proven beyond a doubt that not only telegraph messages, but telephone messages as well, may be transmitted with fairly satisfactory results by this system over considerable distances. The waves may also be made use of for steering torpedoes, which fact was demonstrated on the day in question.

Two of the spectators were asked by the inventor to decide between themselves on a series of evolutions to be executed by a torpedo in the small lake. Both of these gentlemen were familiar with steering terms, and wrote out a set of instructions, which one carried to a distant tent in which the transmitting apparatus was located, while the other was brought to the lake side, where the torpedo lay on the water.

At a signal from a whistle the man beside the torpedo consulted his paper, while at the same moment there was a buzzing sound of the machinery of the little vessel, and the next instant the rudder of the torpedo swung hard aport. Another whistle and the rudder straightened out backward and forward. At every angle in steering the little brass rudder swerved and turned, every motion being checked off by the man by the lake side as correct with a prearrangement made with his associate before the experiment began.

The system is described by an electrical engineer who was present at the tests as follows:

"The advantage of this over other wireless systems arises from the fact that the earth is used directly as a transmitting medium and no natural obstructions interfere with the transmission of the impulses. Stripped of technical terms, the system may be thus described: At the transmitting station are two earth terminals.

"The transmitting instrument, connecting with an ordinary eight volt battery, causes electric action between these terminals consisting of a high potential discharge and low tension current. By this means a number of impulses are set up whose radius of action extend over a certain area.

"Within this area is interposed a receiving instrument, which by a similar, but reversed action, will reconvert the transmitted impulses into mechanical action. For instance, the action of the Morse instrument in dots and dashes is thus conveyed in the earth, transmitted in the shape of impulses to the receiving instrument, where the mechanical dots and dashes are repeated. This system differs from the Marconi system inasmuch as it requires no coherer or overhead poles, while its installation, when perfect, should be simplicity itself. It is certainly the most wonderful electrical discovery of this new century."

Judging from the somewhat meagre information at hand, we should think the system invented by this young Swede in many respects resembles that tried near Paris some six months ago.

* * *

The Electrical Trade With Chili.

While electrical machinery of American manufacture has not yet come into general use in Chili, our trade in instruments and apparatus for scientific purposes, including telegraph, telephone and kindred lines, is steadily increasing. In 1899 this trade amounted to $25,622, increasing to $32,385 in 1900. The outlook for American trade with that country is fairly promising, and it would be eminently so if some means could be devised to enable our manufacturers to compete successfully with Europe in the matter of transportation. It is said that many classes of American products destined for Chilean ports are not infrequently first shipped to Liverpool or Hamburg, and from these places reshipped under a new bill of lading, and are thus accredited in Chili to the latter named countries as European products.

A recent canvass of the houses engaged more or less in handling United States goods at Valparaiso, met with almost universal complaint of the American method of packing goods for exportation. Another alleged cause of complaint is the manner in which packages containing goods for exportation to Chili are marked by American manufacturers. There is a superabundance of fancy letters that puzzle the consignee as well as the Custom House officers. Boxes which carry old marks only partially erased are not infrequently used, so that one is compelled to guess at the mark intended; and even the weight on the same package is sometimes put down in pounds and sometimes in kilos. Each mistake or complication means trouble, if not fines, in the Custom House, and frequently much delay is caused in soliciting the necessary alterations on stamped paper and in traveling from one office to another to procure signatures, etc. Custom House employes grow nervous over many American bills of lading or consular invoices, which contain several packages of the same marks and repeated numbers. Plain, distinct, block letters should be used for marks, and the number below the mark should not be repeated on the several packages.

It might be stated that the Chilean people are not only willing but anxious to trade with the United States, when they can do so on as favorable terms as with other countries. It would seem to be a popular belief (stimulated by foreign commercial competitors) that the Chileans are unfriendly to Americans. This impression is incorrect. Probably no people in South America have better impressions of United States institutions and of the augmenting importance of our country than the Chileans, and probably no people outside of our own boundaries are taking a more lively interest in our success in the world's markets.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

PRESIDENT COFFIN of the General Electric Company has returned from his European trip.

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FORMER owners of the Gerlach Hotel, New York, have sued the Edison Electric Illuminating Company for $200,000 alleged damages, making the claim that the electric plant "is a nuisance."

◆

BERLIN has at length decided to replace lamplighters of flesh and blood by electrical devices, or rather to make experiments with the view of replacing them. A given district is to be lighted by pressing the button, and if the experiment answers the system will be extended to others.

◆

A MEMBER of the faculty of the Moscow Imperial Technical School recently discovered, says a Russian paper, that a microphone, when attached to an electric arc lamp by wire, will transmit sounds through the medium of another electric arc lamp. Repeated experiments were made, in which the two lamps were separated by a thick wall. The inventor read in a low voice a lecture on his discovery, and his words, spoken into the microphone, were comfortably audible in the next room.

◆

THE Canadian Minister of Public Works has decided upon a very important change in the rates to be charged on the Government telegraph lines to the Yukon. The rate for press dispatches, instead of being $3 per 100 words, as at present, will be $1 per 100 words. Cable rates from the Yukon will also be altered. The old minimum rate of $3 a dispatch will be done away with entirely, and there will be no minimum rate. Instead a toll of 40 cents a word will be charged. The question of commercial rates is still under consideration.

◆

PREJUDICIAL effects from the application of the Roentgen rays are sometimes observed when the vacuum tube is very near the patient and worked by a powerful induction coil. In order to obviate this risk, if possible, says the "Electrical Engineer," London, Mr. R. Demerliac recently conducted some experiments in France with Oudin's resonator. He has observed that tubes worked by alternate currents of high frequency and high potential exhibits effects which are curative instead of injurious, and he therefore proposes to utilize this instrument. The experiments showed that tubes designed especially for this mode of working will give as good results as the ordinary ones now in use give with powerful coils.

◆

NEWS has been received from Calumet, Mich., that the Bigelow-Lewishon accumulation of copper on the docks at Dollar Bay will be shipped this fall. The Western Transit line of steamers of Buffalo, N. Y., will take the entire stock East during the next thirty days. There are about 8,000 tons of refined copper, in the form of cakes, bars and ingots, on the docks. This accumulation is the largest lot to be found in this country. By the time the "red metal" is shipped there will be about 2,000 tons more on the docks, the month's output of the Tamarack, Osceola and Isle Royale Companies. The 10,000 tons have been sold to different persons, the total sum realized being about $3,500,000.

◆

ADVICES from England state that an important agreement has just been concluded between Marconi's International Marine Communication Company (Ltd.) and Lloyd's by which the latter agrees to employ no other system of wireless telegraphy than the Marconi system for the period of 14 years. The agreement also provides for the immediate equipment of 10 Lloyd's signaling stations, one of which is to be on the Fastnet Rock, and two on the Red Sea Coast, together with the taking over of some of the existing British stations, of which there are at present eight in number that could be rendered serviceable to Lloyd's for mercantile signaling.

◆

DR. A. PHILLIPS of California, who has invented an electric bath robe, claims that it is more efficacious than either the Turkish or Russian bath, and that the electric current which passes through the body not only imparts a healthy glow to the skin, but cleanses the pores more thoroughly. The bather, he says, is strengthened instead of weakened, as by an ordinary hot water bath. The bath robe consists of a heavy corded quilt six feet long and wide enough to enwrap the bather. This is filled with 300 feet of german-silver wire, which is attached to a coil in a controller. The controller in turn is connected with an ordinary incandescent light. When a switch is turned the electric current passes through the blanket and the latter is heated to a certain temperature. The bather, who is placed in a lying position, is wrapped also in flannel blankets. Profuse perspiration results from the high temperature.

◆

RECENTLY some interesting experiments were carried out at Eskilstuna under a committee of experts appointed by the Sewerage and Scavenger Board of Stockholm, in burning refuse from the Swedish capital, says the "Colliery Guardian." The experiments were effected at the Yunktell mechanical works in the furnace of a boiler mainly intended for the burning of timber refuse and less combustible material. Three wagon loads of refuse had been sent down from Stockholm, which was very unsuitable for the tests, as the refuse contained from 46 to 50 per cent. of water. The results of the experiments were as follows:—(1) That wholly unassorted refuse can hardly be consumed in a furnace of any kind of contruction without the addition of fuel; (2) that the furnace in question was not at all suitable for the burning of refuse, at all events not the kind under trial; (3) that in any case the refuse must be spread in thin layers over a wide area to insure consumption; (4) that the refuse of a heterogeneous and mixed kind does not fall into a uniform layer through a sloping grate; (5) that a furnace for the burning of refuse should be constructed on the principle that the heat generated in the process is as much as possible utilized in the drying of the refuse not yet passed into the furnace; and (6) that besides such heat no further heat for other purposes can be obtained. This is, of course, under the supposition that the refuse is of the kind referred to, in which there were many bits of glass and crockery, tins, etc. However if the refuse be sorted so that the material would consist chiefly of paper, straw, rags, old baskets, etc., the conditions of consumption would, of course, be far more favorable than in the present case.

◆

Gwynn E. Painter, of Baltimore, Md., has secured the patent for an electro-mechanical switch for suburban railways, which, it is asserted, can be used in such a manner that passengers can easily turn on a flood of electric light while waiting at a dark cross-road or station for a car, and at the same time set a signal which will stop the car.

◆

Prof. Willis A. Moore, chief of the United States Weather Bureau, has been at Hatteras, N. C., inspecting the bureau's stations down the coast and incidentally the wireless telegraph system with which the Government is experimenting in that vicinity. Prof. Fessenden, the expert in charge, has, it is stated, made some remarkable advances in the science of telegraphing without wires, and the Weather Bureau chief will inquire into the results.

◆

The present state of the telephone in Australia is being seriously considered in Melbourne with a view to placing the telephone system throughout the country on a uniform basis. Melbourne itself, with a switchboard 30 years old, is said to lag farthest behind, and the want for a standard system of telephony is being keenly felt. It is even stated that not a single telephone system in Australia is equipped with modern apparatus. Steps are being taken looking to the adoption of a uniform and more up to date system in the near future.

◆

Three British patents for the manufacture of alumina or metallic aluminum have recently been published which seem of sufficient interest to deserve notice, says the "Engineer," London. The first is No. 14,572, August 14, 1900, taken out by Mr. C. M. Hall, of Niagara Falls. In this bauxite is calcined with a small quantity of carbon, and then more carbon is added till the proportion of that material reaches 8 or 10 per cent. of the whole. A certain proportion of aluminum powder, calculated according to the richness of the bauxite in ferric oxide, silica, and titanic acid, is next introduced in order that an alloy of that metal with iron, silicon, and titanium may be subsequently formed and removed; and if the mineral contains but little iron, ferric oxide may be added to bring the percentage of that constituent up to the desirable minimum, while in some cases a flux such as lime, soda, cryolite, or fluor-spar, is also employed. The mixture is brought into an electric furnace constructed of a metal jacket and a carbon lining, having a vertically suspended electrode, etc., and a tapping hole at the bottom. The current is turned on and the material is fused, working either at a very high temperature, or for a long period of time, until the above-mentioned alloy is produced. The second patent, No. 14,573, August 14, 1900, was also taken out by Mr. C. M. Hall. Here calcined bauxite is digested in a closed vessel, with a solution of sodium carbonate in such proportions that two or three molecules of $Na_2 CO_3$ are present for every one molecule of $Al_2 O_3$ in the ore; and with enough quicklime to causticize the former reagent. Steam at 140 pounds pressure is led into the digester, and its contents are agitated for several hours. The solution of sodium aluminate is filtered, and then treated with a current of carbon dioxide, as in Deville's original process, to throw down the alumina. The third patent is No. 9,676, May 9, 1901, taken out by Mr. A. H. Cowles, of Cleveland, and the British Aluminium Company. It relates to the manufacture of aluminum, sodium, aluminum carbide, and alloys of aluminum with sodium or other metals. A mixture of sodium aluminate and powdered carbon in proper proportions is made up and heated electrically in a closed furnace, one wall of which is permeable to gases and vapors. The sodium is reduced to the metallic state, volatilizes, passes through the diaphragm, and is condensed in a suitable vessel; the aluminum is also reduced, and remaining in the furnace, combines with the carbon to yield its carbide. If to the above mixture a compound of some non-volatile metal is added, there is obtained an alloy of aluminum with that non-volatile metal, the sodium escaping as before.

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The annual report of Brig. Gen. George M. Randall, commanding the Department of Alaska, was recently made public by the War Department. The report is dated at Fort St. Michael, and General Randall says: "In connection with the telegraph line it is proper to remark that in the original plan for its construction it was proposed that a large section of the line should be for the present a land cable, to be replaced gradually by a permanent line, regularly constructed, should the conditions justify; also that St. Michael's would be connected by cable with Unalaklik, the point of departure from the coast to the Yukon. The total length of line constructed up to date aggregates approximately 400 miles. The work is being pushed along the Yukon River above Nulato and by the close of navigation in September it is hoped there will be telegraphic communication between this point and Fort Gibbon, a distance by the line of about 420 miles. There are many difficulties to be overcome in such construction, and which are peculiar to the Arctic climate. Along the coast of Norton Sound and a portion of the Portage from Unalaklik to Kaltag is a 'tundra' country, merging into spruce forests, with dense undergrowth as the Yukon is approached. This latter condition extends generally throughout the Yukon Valley. The cable from St. Michael to Nome, which was laid by the Alaska Commercial Company, salvors of the cable ship Orizaba, and operated for a time last fall, was carried away by the ice in November and has not been recovered up to the present time."

THE BEST MANNER AND MODE OF CONDUCTING THE RETURN CIRCUIT TO THE POWER HOUSE.*

BY E. G. CONNETTE.

The writer is somewhat at a loss for new material to offer on this subject, as it has been discussed for years, and improvements introduced until the present practice of using the rails with bonded joints for conducting the return circuit has been practically perfected, so far as the use of the rails of the track can be utilized for that purpose; especially when the highest state of the art of bonding the joints is particularly observed and the work carefully done. A large portion of the troubles which exists under the present practice is on account of inefficient, careless work, and the use of faulty material, but even when the greatest care is observed and the best material is used in bonding the joints, the deflection of the joints in the course of time from various causes will impair the efficiency of the ground return.

A few years ago when electricity as a motive force had been perfected to such a degree as induced the street surface railroads to transform their motive power from horse power to electric power, there were two electric companies in the field offering apparatus for street car propulsion, viz., the Sprague Electric Company and the Thomson-Houston Electric Company. In 1890, the writer assumed the management of a street railway company, a part of which was being equipped by the Sprague Electric Company and the other by the Thomson-Houston Electric Company. The Sprague Electric Company used the rails of the track exclusively for conveying the return circuit and used a No. 6 galvanized iron band, riveted to the rails, around each joint. The Thomson-Houston Company used an auxiliary copper, the same size as the trolley wire, laid in the center of the tracks on the tops of the cross-ties, connecting the same with a wire of a smaller size with a rivet to the center of each rail, and I believe that it was their idea to use the same amount of copper wire for the ground return along the tracks, connected in the manner as above described, as was used overhead. In a few months it was discovered that the voltage on the lines equipped by the Sprague Electric Company was very low, especially towards the end of each line, and upon investigation, it was found that the galvanized iron bands had almost entirely disappeared, while on the lines equipped by the Thomson-Houston Company the loss in potential was about the same as when the work was first installed; the rail joints of the Sprague lines were rebonded with copper bonds riveted to each rail, but in the course of time, it was further discovered that these bonds were too small in size, and that the loss of potential was gradually increasing on account of the bonds deteriorating and being broken off, and it was necessary to go over the lines again and rebond them. On account of the large initial expense of an auxiliary ground wire and of the improvements and progress in the method of bonding the joints and the use of heavier rails together with the improved method of supporting the joints, the use of the auxiliary wire in the ground for the return circuit was abandoned. With the great variety of devices and improvement in the art of bonding the rail joints at the present time, there is yet more or less trouble experienced, and the tendency is toward a jointless metallic return by using electrically welded or cast-iron joints, which practically makes an unbroken metallic return, so far as the tracks are concerned; but, unfortunately, a large number of street railroads are not financially able to relay their tracks with heavy rails and use the improved method of joint support and connections, and the problem with them is yet unsolved as to how to bond the joints of the rails so as to get a perfect connection with one that will stand and overcome all resistance or loss. It must be remembered that in a mile of track there will be from 179 to 352 joints, and while the rails of the track have more than ample capacity for conveying the current, the joints must be so connected as to give the current a path across of but little or no resistance; when the joints are properly bonded, the track for a period of time answers well for a return circuit, but after a while the connections at the joints become corroded, the bolts are worn, the joints deflect, and the bonds here and there are either broken or worn in two, or corroded and loose at the connection, and the result is a very imperfect and inefficient ground return. In some instances there is an insufficient amount of wire used for the return circuit from the tracks to the power house, and in some cases when there is enough wire for this purpose, the connections to the rails are inadequate and create a resistance that neutralizes the conveying capacity of the copper intended to convey the return circuit to the power house. The wires of the return circuit should be connected to the rails with a connection of equal capacity to the conductor, and should be connected in three or four places, so that if one should be broken or disconnected, there would still be ample carrying capacity in the other connections.

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*Paper read at the 20th Annual Convention of the American Street Railway Association, held in New York City, October 9-11, 1901.

In the early days of telephone exchanges, the ground was used as a return circuit, and we are all familiar with the inefficient and poor telephone service while this state of things continued. The service was disturbed by the trolley currents and other influences until finally the telephone exchanges were forced to put up a metallic return in order to save trouble, annoyance and disturbances to their service, and I believe after a trial it was discovered that the expense of putting up the metallic return was more than compensated for, by the improvement in the efficiency of their service, and was money well invested.

It is therefore, the opinion of the writer, that "the best manner and mode of conducting the return circuit to the power house" is by using practically a jointless and independent metallic return, connected to each rail, and the connection made with ample surface contact and absolutely water tight, on account of the chemical action, which is likely to take place between the copper rivet and the steel rail, the rivet should be covered with a thick coating of lead, solder or tin; the best connection which can be used, if the facilities are available, is to electrically weld the connection from the auxiliary ground wire to the center of each rail, and, I dare say, that even with the extra initial cost of an independent ground wire, it will result economically in the long run. If an independent metallic return circuit was the custom now, there would be no necessity for a paper to be written on this subject; there would be no more need of discussing the subject of rail bonding, or of electrolysis, or of the best method of discovering bad connections in the return circuit, and the expenditure of a large amount of money for expert investigation and advice to cure the bad results of the present imperfect system of conducting the return circuit to the power house; and the amount saved by loss of power, cost of rail bonds and labor of renewals, tests and investigations, as well as the trouble and expense incident to electrolytic action will be more than ample to ground return.

Cast-iron joints and electrically welded plates on the joints makes the rails of the track practically a jointless metallic circuit as a conveyance for the electric current, but the very large number of joints in the rails of the track makes the certainty of an unbroken and continuous metallic circuit a doubtful proposition, as the wear and tear of heavy traffic, and the expansion and contraction of the metal will, in the course of time, produce results, which may very materially impair the efficiency of the joints as a perfect conductor, and it appears to the writer that it is just as essential to have a conductor of as perfect and as efficient in carrying capacity, to convey the current back to the power house, as is used to convey the current from the power house to the car, and if this were the case, there would be no more troubles with the return circuit. I do not advocate a double trolley, because of the difficulties which are well known to street railway people, but an independent metallic return used in connection with the single trolley system is not as expensive to install as the double trolley system, and, practically, obviates all the troubles incident to the ground return where the rails with bonded joints are used for the return circuit.

MISCELLANEOUS NOTES OF INTEREST TO CENTRAL STATION MEN.—X.

BY W. H. WAKEMAN.

Many reasons are advanced for forcing boilers beyond their rated capacity, while others are given for expecting a reasonable service from them and no more, but the idea that it is proper to work a boiler as hard as possible until it is worn out and then get a new one, is a rather novel way of stating the case. If steam users wish to pay for coal wasted in this way there is no law to prevent them from doing it, so far as I am informed, but the great trouble is that it is difficult to convince the owner of a plant that his boilers are worn out, for if his engineer claims that they should be taken out at once, the owner may not heed the advice given, and if they run for one month more, there appears to him that there is no reason why they cannot run two or three months longer, hence they are used after they are unsafe.

Some engineers claim that it is a good plan to use a gasket several times over for packing the man-hole cover of a boiler, while others say that a new gasket should be put on every time that the cover is to be put in place after the boiler has been opened. They claim that this is a very important job, and that a new gasket is none too good for it. This is admitted, but the question to decide is whether an old gasket will fit into place and make a good joint, or if a new one is more reliable in this respect. Some of the surfaces to be packed are quite rough, but this makes no particular difference, provided the man-hole cover is marked and put back in the same position that it was taken out of, for the gasket will then fit into place and make a good joint. If an old gasket is turned bottom upwards there is sure to be trouble, for it will not hold water. If it is desired to use the same gasket several times, the face of the joint on the inside of the boiler should be covered with graphite, or with chalk in order to prevent the rubber from sticking to it when the cover is removed. If it is to be used only once there is no necessity for putting anything on it either to make it stick or to prevent it from sticking.

I have heard of several cases where the packing of a man-hole cover has blown out with a full pressure of steam on the boiler. It seems as if this was hardly possible when the joint is made as it should be in the first place. When fitting the hand-hole covers into a pair of new boilers I noticed that when the covers were put in place without gaskets they did not fit properly, as they bound in the hole before the face reached the head. It is possible for a man-hole or a hand-hole cover to bind at this point so as to prevent the gasket from being clamped tightly in place, when the pressure might blow it out.

Sometimes the engineer or the fireman will put a man-hole cover in so carelessly that the tubular gasket is cut in two, making a bad leak. In other cases the joint in the tubular gasket is not properly made, so that both ends of it are not clamped as they should be, the result of which is that one of them is forced out of place by the pressure, making it necessary to empty the boiler and put in a new gasket. This not only causes delay, but may result in injury to the engineer or fireman in charge, as it is natural to make every effort to repair the damage as soon as possible, and while so doing more than one man has been badly scalded.

It is sometimes claimed that all of the impurities in the water that is fed into a boiler remain in the shell when the water is evaporated, but this is not strictly true, for some of them will be carried over with the steam, whether it is used for running an engine, for heating a building, for cooking food or for making beer. If water is carried over with the steam, some of the impurities that go over with it may damage the cylinder of an engine, and food or beer may be spoiled by foreign matter which the steam contains. I have seen safety valves badly coated with soda ash that was used to remove scale, and which was supposed to stay in the boiler until the water was changed.

Whenever an engine is wrecked by a charge of water entering the cylinder of it, the fireman is sure to be blamed for carrying the water level too high and thus causing the trouble, but he should not be condemned without a full and impartial investigation. My attention has just been called to a case of this kind where the engineer of a large plant claimed that he could not get the best results from the steam furnished him, because water came over with it. The boilers are some distance away from the engine, so that the boiler room was placed in charge of an intelligent fireman, and when told that he carried his water level too high he protested vigorously. One day when a charge of water came into the cylinder, the engineer and superintendent went to the boiler room at once, and found the water level no higher than it had ought to be. This convinced them that the fireman was right when he claimed that the fault was not his. Further investigation showed that the main steam pipe did not have a continuous pitch towards the engine, but there were places where water could stand in it. This gave no trouble so long as the load was light, but when a heavy load came on the larger quantity of steam called for rushed through the pipe, carrying the water with it, hence the trouble. The pipe had recently been put up but it was necessary to remodel it before the trouble could be cured. Some of the engines at the Pan-American Exposition have been damaged by water in the steam furnished, but this does not necessarily mean that the boilers prime badly, nor that the firemen are careless, as the above incident plainly shows.

The fusible plug in a tubular boiler should be located in the rear head three inches above the upper row of tubes. One inch above these tubes is not enough, because the rear end should be set about one inch lower than the front end, so that all of the water will drain out, when the blow off valve is opened. When the fusible plug is three inches above the tubes on the rear end there will be only two inches of water at the front end, when the plug melts out, and this is none too much for safety. There seems to be a conflict of authority concerning which end should be placed towards the pressure, for while some say put the large end in, others claim that the small end should look inward. When an engineer buys one of them he usually proceeds to screw it into place in the only way that it will go in, without spending much time in speculation, but it does no harm to investigate these matters in order to fully understand them. If the large end is put outward, the steam pressure may blow out the filling before it melts, which makes it appear as if the water had been allowed to get low when it has not. While investigating this matter I found that many of these plugs were made so that the filling appeared to be without a taper when viewed from the outside, but when cut open it was plain that the largest part of it was at the center, so that they could be put in either way and prove equally effective. The inside end of these plugs should be kept free from scale and sediment while in service, because otherwise they may not melt out as soon as the water level falls below them.

A tubular boiler should be set so that the upper row of tubes will be level crosswise of the boiler, because if one side is set higher than the other, that side will have less water over it than the other. If the dome does not stand vertical when set in this way, or the steam nozzle leans one way or the other, they should be taken off and put on properly, or else the piping should be brought into its proper place by cutting drip threads, or by using flanges that are thicker on one edge than the other.

Cases continue to be reported where pipes used under high pressures are found to be holding by one or two threads only, owing to careless steam fitters having charge of jobs when they were in course of erection. This is a dangerous practice and measures should be taken to put an end to it at once. If a rule requiring each joint to be made up separately was rigidly enforced it would be a great improvement, because a steam fitter frequently starts two or three joints on the same pipe, and then screws them up together, therefore if one of them does not screw in as much as it had ought to, he does not notice the difference.

ELECTROLYSIS AND INSURANCE.*

BY HUBERT SCHUURMAN WYNKOOP, M.E.

To no one is the subject of electrolysis of more vital interest than to the fire underwriter, and yet it is doubtful whether the average insurance man gives to the electrochemical destruction of our underground metal work more than a passing thought.

In a broad sense the process of electrolysis consists in the passage of an electric current through a solution of metallic salt, from an oxidizable metal to some other conductor, the salt being thereby separated into two parts; first, the metal, appearing at the negative electrode; and, second, an unstable compound of the remaining elements. This unstable compound is supposed to unite with the hydrogen of the water, liberating oxygen and forming an acid. Both oxygen and acid appear only at the positive electrode, which is thus made subject to a double decay—a corrosion by the oxygen and a solution by the acid.

A little study of the conditions existing in a trolley town will convince one that, theoretically at least, gas pipes, water pipes, railway tracks and other artificial conductors are gradually disintegrating, and that electrochemical action is a factor in accelerating the decay. These conductors are the electrodes. In contact with them is the soil, containing an electrolyzable salt—chloride, nitrate or sulphate of ammonia, potash, soda or magnesia. Add to these moisture and electricity, and electrolysis is set in motion.

The moisture is the natural dampness of the soil; the electricity is the current of the street railway generator.

This view of the sub-surface electrical conditions of the town opens up enormous possibilities. The size and distribution of the elements of our gigantic cell require a correspondingly large supply of electricity; and it has been reserved for the grounded return trolley system, unfortunately, to demonstrate its ability to furnish current enough to carry on this deplorable electro-chemical destruction.

The ordinary trolley railway, then, is indisputably responsible for increasing our fire hazards; for, if the destruction of piping and other metals laid underground can be proven—and this involves no difficulty whatever—the disastrous results of this destruction speak for themselves.

The current of the street railway system, after passing through the car motor, is led to the rails, whence it is expected to find its way back to the power house via the rails—and, incidently, via any other path or paths that may be available. With strict impartiality this "return current" divides itself up and travels the various paths, in quantities inversely proportional to the resistances encountered; and those portions of the current which do not confine themselves to the rails and the return feeders, but pass homeward along pipes, etc., are classed as "stray current," "vagrant electricity" or "trolley leakage."

Such is the theory, and unfortunately, the practice as well. From all points of the compass are coming in complaints of the failure o gas and water pipes, the accompanying evidence indicating conclusively that the inception of electrolytic troubles was in each instance coincident with the placing in service of the electric street railway.

Our latest information indicates that no industrial metal is free from electrolytic trouble —given the proper conditions—and that cast-iron seemed to be safe only because it responded more slowly to the attacks of free oxygen and acid. Prof. Samuel Sheldon has shown that the retarded effect upon cast-iron is due to the "skin" which consists of a silicate of iron.

The ultimate breakdown of a water main cannot be predicted at the present day as in the past. Formerly, we might safely count on a life of 10, 20 or 40 years for our cast-iron pipe. Now that electrolysis has been added to the ordinary process of rusting, the pipe life may be one year or 40 years, depending not only upon the character of pipe and soil, but also upon the unknown and shifting electrical conditions.

The failure of a water main cannot cause a fire, but the breakdown of a pipe used for the distribution of gas is a direct cause of fires, which may originate under a number of conditions.

Several years ago it fell to the lot of the writer to investigate in detail the circumstances attending a "man-hole explosion." The subway affected paralleled an electric street railway, being about 5 feet distant from the nearest rail. Overhead was a steam elevated railway, while the street pavement consisted of granite blocks. In order to protect the lead sheathing of the cables from electrolysis, bond wires had been used to connect the armors electrically with each other, with the man-hole head and with the rails. At the point of the accident some of these bond wires were found to have been disconnected, whether as the result of the explosion or not could not be determined; but an inspection of other man-holes developed the fact that the bond wiring as it actually existed was favorably arranged to encourage a difference of potential between adjacent bonds or between bond and lead, or bond and man-hole head. Indeed, the attachment of a voltmeter to various pairs of points in one man-hole secured readings ranging from zero up to 1 and 1½ volts.

The man-hole cover at the point of explosion being without vents, the notion of a discarded lighted match was untenable; nor did it seem wise to saddle upon spontaneous combustion the responsibility for gas ignition so long as a more plausible explanation might stand in the foreground. So the report was made to state that the explosion was due, primarily, to an accumulation of gas in the subway, for which the gas company was responsible owing to leaks in its pipes, and for which the subway company also was responsible on account of its failure to so ventilate its subway as to care for the stray gas which was known to exist; and that, in the second place, the gas was probably ignited by an electric arc between two conductors at different potentials, which conductors were intermittently jarred into contact by the vibration from a passing wagon or car. The writer further stated that, in his opinion, the difference of electrical potential was due largely to the stray current from the trolley system.

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*Abstract from "Insurance Engineering."

While the hurtling man-hole cover can hardly be classed among fire risks, it is interesting to note that the back-flash of the explosion traveled along a subsidiary duct until it entered a nearby building, where a fire which ensued a short time after was subsequently attributed by many to the explosion in the subway.

In this instance the trolley leakage introduced a fire risk through the intervention of electrolysis; for the gas leakage was shown later on to be due largely to excessive corrosion of the gas mains, rather than to the ordinary leakage at the pipe joints.

The fire underwriter must perforce give due heed to the preservation of gas mains from the ravages of electrolysis.

Now these citations are sufficient to show that the proper disposition of the return current of the electric street railway constitutes a problem, the solution of which is of much importance to insurance people. Day by day the danger is growing; and, notwithstanding all the investigations that have been undertaken and the palliatives that have been applied, the remedy has not been found. At present we are only temporizing, fearing to banish the grounded return trolley, and hoping at some early date a remedy for electrolysis and its kindred evils may be discovered. But when the fire insurance interests once become keenly alive to the destruction that is now going on there will be no further delay, no temporizing; but, instead, prompt, decisive action. And, outside of processes at law, it is to the fire underwriters that the gas and water companies must look for relief.

CANADIAN NOTES.

The Canadian General Electric Company has arranged with the Dominion Government to develop power at Nassau Mills for use in the Peterboro works of the company. Nassau Mills is on the canal about three miles above Peterboro.

Arrangements are reported to have been completed for the building of an electric railway system to connect the leading towns of the island of Cape Breton in the province of Nova Scotia.

The street railway, electric light, incandescent light and telephone companies of Toronto, Ont., have appealed against the increase of their municipal assessments that have just been revised and placed upon them. These increases appealed against are: Street Railway Company, $1,156,000, of which $700,000 is on its cars, which have never before been assessed; Bell Telephone Company, $475,000 on poles, plant and wires; Electric Light Company, $129,000, and Incandescent Light Company, $165,000 on plant.

There seems to be little doubt that Edison has solved, or is on the point of solving, the problem of securing storage batteries of a much lighter metal than lead. A few weeks ago it was announced that Mr. Edison was developing a process for the use of nickel for storage batteries, and following this came a visit to Sudbury, Ont., and an investigation of Ontario's resources. Recently a letter was received at the Ontario Bureau of Mines from Mr. Edison stating that he has a dozen prospectors at work now around the Sudbury district searching for nickel veins, and when spring comes he will put twice as many prospectors in the field.

THE MODERN POWER HOUSE INCLUDING THE USE OF COOLING TOWERS FOR CONDENSING PURPOSES.*

BY J. H. VAIL,

Mechanical and Electrical Engineer, Philadelphia.

It is not the purpose of this paper to enter into the minute details of what should comprise the equipment of an individual modern power generating station, these general features being too well known to warrant repetition, but I preferably invite your attention to improvements in certain directions which make for economy, and that may with advantage be introduced into existing or prospective stations.

I submit the proposition that it is not good business policy to maintain in operation a wasteful plant, for the reason that as compared with an economical plant of equal capacity the wastefulness in fuel, water or other costs of operation must be capitalized according to the ratio of the increased cost of operation and maintenance. Therefore the engineering question of judicious selection of auxiliary equipment to reduce wastefulness becomes of prime importance to the business man who anticipates reaping the largest attainable profit from his investment in the electrical field.

There should be a sensitive perception of the particular advantages to be derived from the combination of certain types of appliances in any particular station according to its locality. The application of economical auxiliaries in a station is to a certain extent a commercial as well as an engineering problem, for the reason that the engineer is expected to design and build the station equipment to the end that the highest commercial results may be obtained.

The application of any special economic device will be justified when by careful analysis it is determined that the savings derived will repay:

1. All cost of maintenance, depreciation, attendance and operation.
2. A fair interest on the initial investment.
3. A reasonable profit in addition.

The environment of the station will largely determine many of the leading features of its equipment. For instance, there are towns in the coal regions where the cost of fuel is so low that the saving elsewhere usually secured by condensation will not be sufficient to pay the interest on the cost and maintenance of the additional equipment needed to operate a condensing engine, but these exceptionally favorable conditions are so rare that while worthy of notice we can best devote our attention to the locations where money can be saved by the introduction of new methods at a reasonable cost.

Prof. R. H. Thurston at the New York meeting, 1899, of the American Society of Mechanical Engineers has fully set forth the progress in steam engine efficiency, summarizing the economy obtained in the best practice to date, and finally concluding that the steam engine has now been so far perfected that but little more can be expected from the designer. If we would secure additional economies we must look for them outside of the engine, and I venture to advance some suggestions that I believe are justified from results attained, and with large compound or triple expansion condensing engines.

The advantages obtained with a condensing which if adopted in combination where fuel and water are important items of operating expense will materially reduce the cost per horse power hour.

The use of pulverized fuel I venture to advance as one of the lines for greater economy of fuel in the future for several reasons:

1. More perfect combustion can be obtained, resulting in the possible utilization of a larger proportion of the heat units contained in the coal.
2. As the coal is pulverized by machine and by automatic regulation supplied to the furnaces, the labor of firing is reduced to minimum expenditure. One man can attend the furnaces for at least 1,000 hp. of boilers.
3. As every available particle of combustible is burned, there is a saving in the handling of ashes. I have seen stations where 5 to 10 per cent. of good coal was thrown away with the ashes.

At many large cement works most effective and satisfactory methods of firing with pulverized fuel have, to my personal knowledge, for a long time been in successful and continuous service in rotary kilns for burning cement clinker, which require to maintain a temperature of 3,000° F. The method of burning pulverized fuel with an air blast is the most advantageous, as it admits of a more accurate adjustment of the supply of air and fuel, almost ideal combustion is secured, similar to the burning of natural gas, and all requisite flexibility may be obtained for controlling the supply of combustible and the steaming production of the boilers.

In adopting the use of pulvervized fuel there will be required a larger combustion chamber, and the boilers should have a larger proportionate heating surface to enable them to absorb the increased available heat units obtained from the better combustion of fuel, or with boilers of a given heating surface and steaming capacity less fuel will be used; the opportunity of using a cheaper grade of fuel should not be overlooked.

At the May meeting in Milwaukee of the American Society of Mechanical Engineers this subject was presented and discussed, showing that its employment has emphatically passed far beyond the theoretical stage. The superheating of steam means the raising of its temperature after its generation in the boiler, without greatly increasing its pressure. The idea is not new, as the subject has been followed up with more or less success for the past fifty years. The theoretical economy hoped for and practicable methods of its attainment have been persistently sought, the difficult problems have one by one been worked out, and the obstacles one by one overcome until now application of superheating will be contracted for by reputable concerns, and very high economies obtained.

It is stated that with horizontal tandem compound engines of comparatively small power, an economy of 9.50 to 9.76 lbs. of steam per i.h.p. is obtained, while in larger engines 8.97 has been reached. The writer does not claim to have personal experience with superheated steam, but is informed by one of our most conservative engineering firms that they will contract for installations and guarantee under stipulated conditions a steam consumption not exceeding 10 lbs. steam per i.h.p., equipment are so fully and generally recognized by engineers of good repute that we need not dwell on these details, but we all recognize the fact that many stations for various reasons are so unfavorably located as to be deprived of the advantages of an ample supply of cooling water, and to the managers of such stations the benefits to be derived from the cooling tower must appeal with unusual force if care is bestowed in analyzing the cost of equipment, the benefits derived and the economy effected.

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*Paper read at the 20th Annual Convention of the American Street Railway Association, held in New York City, October 9 11, 1901.

The idea of artificially cooling the temperature of circulating water to make its continuous use available for condensing purposes is not new. Many methods have been described in the technical papers. There have been used series and tiers of iron pans, plank troughs, spray pipes, tubular tiles set vertically with broken joints, suspended woven wire mats or partitions set as open towers, or with enforced air circulation by fans, shallow tanks, etc., all of which have been more or less effective. Thus it will be seen that the methods of artificially cooling water for condensing purposes have been subjects of experiment along various lines for many years, and the final result of experiments and investigation is concentrated in the present successful design of a cooling tower that so distributes the water that the greater area of surface is exposed to the air circulation, and the vapors resulting from evaporation are successfully dissipated, either by natural circulation or forced draft.

The cooling water therefore actually fills the gap of affording the needed opportunity for economy where the environment of an inland station would otherwise require that particular company to continue to expend its money for an extravagant waste of fuel and water.

A practical illustration is the 26th street station of the New York Edison Company, designed by the writer in 1887 and started in 1888. The maximum equipment was limited to 2,600 hp. with the best selection of apparatus then obtainable. But with the originally designed boiler capacity we now find with improvement in engines and dynamos, and the application of cooling tower and condenser system, the maximum capacity is increased to 6,000 horse power.

I could state several instances where I know large expenditures were purposely made to locate the power house at a convenient point for water supply, frequently incurring an extra expense for coal delivery and a large investment in long pole lines or systems of underground conduits and conductors; the combined cost of which was greater than a cooling tower, and the net results would not compare favorably.

There are now upwards of 500 cooling tower installations that range in capacity from 250 to 12,000 hp., which is substantial evidence that the cooling tower is not experimental, but when applied by an experienced engineer is beneficial; the advisability of its application in any specified station becomes a question that must be determined from the commercial and engineering analysis previously suggested. To those who may contemplate the installation of cooling tower and condenser equipments I would earnestly suggest that for the entire equipment a liberal margin of capacity be allowed over and above the maximum estimated service, for the reason that a combination of conditions may arise where a heavy load is demanded under adverse atmospheric conditions, and in such event a very liberal supply of cooling water will be required for effective condenser service. The cooling water should be estimated at not less that thirty times the steam consumption of the engine, and two thousand times more air than water will be required.

The heat extracted from the water by passing through the tower will depend upon atmospheric temperature, humidity, etc., but actual results show a range of from 30 degrees to 50 degrees reduction of temperature and a vacuum from 23 to 27 inches is readily obtained.

Under certain conditions there will be a small loss of water due to evaporation in passing through the tower, say from 1 to 3 per cent.; where the circulating water is kept separate from the boiler feed this loss can be made up at slight cost. In a carefully designed equipment of cooling towers with surface condensers and grease extractors, the cost of boiler feed water can be reduced to the purchase of a very small amount to make up for losses by evaporation and leakage.

Where conditions for installation are favorable the open cooling tower requiring no expenditure of power for driving fans shows excellent results, as attested by the following extracts from daily log records of the power station at Plainfield, N. J., during July, 1901:

Open Tower—Temperature.

Date.	Atmosphere.	Condenser discharge.	Condenser suction.	Degrees reduction.	Vacuum inches.
July 1, 3 P.M.	104°	124°	100°	24	25
July 1, 12 M.	100	130	100	30	25
July 1, 8 P M.	102	130	100	30	25
July 1, 9 A.M.	98	130	100	30	25
July 2, 3 P.M.	106	146	104	42	23
July 2, 12 M.	104	140	102	38	23
July 2, 9 A.M.	102	138	102	36	23
July 3, 12 M.	100	134	102	32	24
July 4, 6 A M.	76	112	84	28	26
July 6, 12 M.	84	126	100	26	26
July 9, 6 A.M.	68	120	96	24	26
July 10, 3 P.M.	86	123	92	31	26
July 12, 6 A.M.	70	106	84	22	27
July 13, 6 P.M.	77	124	96	28	26
July 15, 12 M.	90	120	94	26	26
July 15, 3 P.M.	90	128	98	30	28
July 16, 9 A.M.	86	128	94	34	26

The forced draft or fan type of tower possesses a wide range of flexibility in manipulation, and where the amount of heat to be removed is great and under severe duty in the hot summer months more work can be done than with the fanless type.

In an equipment of forced draft towers it is very important to have facilities for driving fans at variable speed. This requisite flexibility is better obtained by having a small engine direct connected to the shaft of each pair of fans than by a motor drive. The exhaust from the engines can be used to heat the boiler feed or can be condensed. Under varying conditions of temperature and load the speed of the fans can be increased or decreased. In winter there are many hours when the low temperature of the air circulating through the tower will cool the water without running the fans, while during the high temperature in summer the fans must be run at maximum speed.

The combined air pump and jet condenser may be used where the cooling tower is located at the ground level, but where it is set on a roof or much elevated above the pumps it is preferable to use the surface condenser, as there will be a balanced water column and the work on the pump is simply against the head of water due to the height of the tower. Motor driven pumps are suggested as being preferable to steam pumps on the score of economy.

Having stated the conditions under which the cooling towers may be installed to secure the advantages of condensing systems let us briefly investigate the results attained.

I submit the following table prepared from daily records in a log book of a power station equipped with the fan type of cooling towers, and operated under the writer's supervision, which gives a fair range of working conditions in different months:

Time.	Jan. 31. 9 P. M.	Feb. 8 P.M.	June 20. 6 P.M.	July. 8 P.M.	Aug. 28. 8 P.M.	Nov. 4. 5:35 P.M.
Temperature atmosphere, deg	30	36	78	96	85	59
Temperature condenser discharge to cooling tower, deg	110	100	120	130	118	129
Temperature condenser suction returned from tower to tank, deg	65	84	84	93	88	92
Degrees of heat extracted through tower	45	26	38	37	30	37
Speed of fans at tower, r. p. m	36	0	145	162	150	148
Vacuum at condenser, inches	25½	26	25	24½	25½	25
Strokes of condenser pump	30	30	37	44	43	28
Pounds boiler pressure	110	110	120	120	120	112
Temperature boiler feed, deg	212	212	210	211	213	213

It will be noted from the table that an atmosphere temperature of 96 degrees, and the temperature of condenser discharge 130 degrees we extracted 37 degrees of heat by passing the water through the towers and obtained a vacuum of 24½ inches.

In the same station we did the following work with a tandem compound condensing engine rated at 750 hp.:

	Maximum.	Minimum.
Temperature, atmosphere, deg	103	83
Temperature, condenser, discharge to tower, deg	128	106
Temperature, condenser suction, deg	98	91
Degrees of heat extracted through tower	32	21
Speed of fans, r.p.m.	160	140
Vacuum at condenser, in	26	20
Strokes at condenser pump	50	38
Pounds boiler pressure	121	100
Temperature, boiler feed, deg	212	200
Engine, horse power developed	900	400

I note these instances which I know to be facts simply to show results obtained under extreme conditions.

In this same plant indicator diagrams were taken of the engine, air pump and fan engines. The results were as follows:

Engine, r.p.m.	120
Steam pressure, lbs	112
Vacuum at condenser, in	25

Work done in high pressure cylinder 311.8 hp.
Work done in low pressure cylinder 331.5 hp.

Total output........................ 643.3 hp.
Work done in L.P. cylinder below
atmospheric line.......... 1 hp....185.1
Deduct work done by air
pump..................... 13.75 hp......
Deduct work done by fan
engines.................. 13.5 hp....27.25

This shows a net gain of 157.85 horse power by the use of the condenser and cooling tower.

The cooling tower was located on the roof and water was elevated 58 feet. using an air pump and jet condenser. Had a surface condenser been used the results would have been still better, as the work on the pump would have been less with a balance water column.

A fan tower is also used at Plainfield, N. J., and extracts from daily log records show the following results.

TEMPERATURE.

Time.	Atmosphere. Deg.	Condenser discharge.	Condenser suction.	Degrees reduction.	Vacuum inches.
July 4, 3 P.M.	94	128°	96°	32	25
July 4, 6 P.M.	86	132	96	36	24
July 10, 3 P.M.	86	123	92	31	26
July 11, 12 M.	90	138	102	36	24
July 11, 3 P.M.	92	138	102	36	24
July 11, 6 P.M.	88	136	96	40	25
July 14, 6 P.M.	88	130	98	32	24
July 15, 12 M.	90	120	94	26	26
July 15, 3 P.M.	90	128	98	30	26
July 15, 6 P.M.	84	130	98	32	25
July 16, 8 P.M.	86	142	102	40	33
July 16, 10 P.M.	84	140	104	36	23
July 16, 12 M.	80	138	102	36	24
July 17, 6 A.M.	78	130	102	28	25
July 17, 12 M.	74	122	100	22	25

It is a matter of regret that careful log records of operations are not maintained in all power stations.

Special emphasis should be placed on the value of careful inspection, regular cleaning and skillful adjustment of the entire station equipment. Carelessness in these matters wastes many dollars that could readily be saved without extra cost of labor.

In conclusion, I thank you for your courteous attention and in summing up will say that I believe the time is near at hand when the engineer who is afforded sufficient scope in designing a plant can select a combination for a station equipment of upwards of 1,000 hp. capacity that will in daily operation successfully produce one indicated horse power from one pound of good coal.

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New Trains on the South London Electric Railway.

When the City & South London Railway opens its Islington extension on November 1, says our London correspondent, it will bring into service eleven new and enlarged trains. Each train will have four coaches with double compartments. The roof is raised in the center to permit the introduction of ornamental ventilators. The electric lights are inclosed in corrugated globes. The cars were built by the Bristol Wagon Company, and are a great improvement on those which have done service up to the present.

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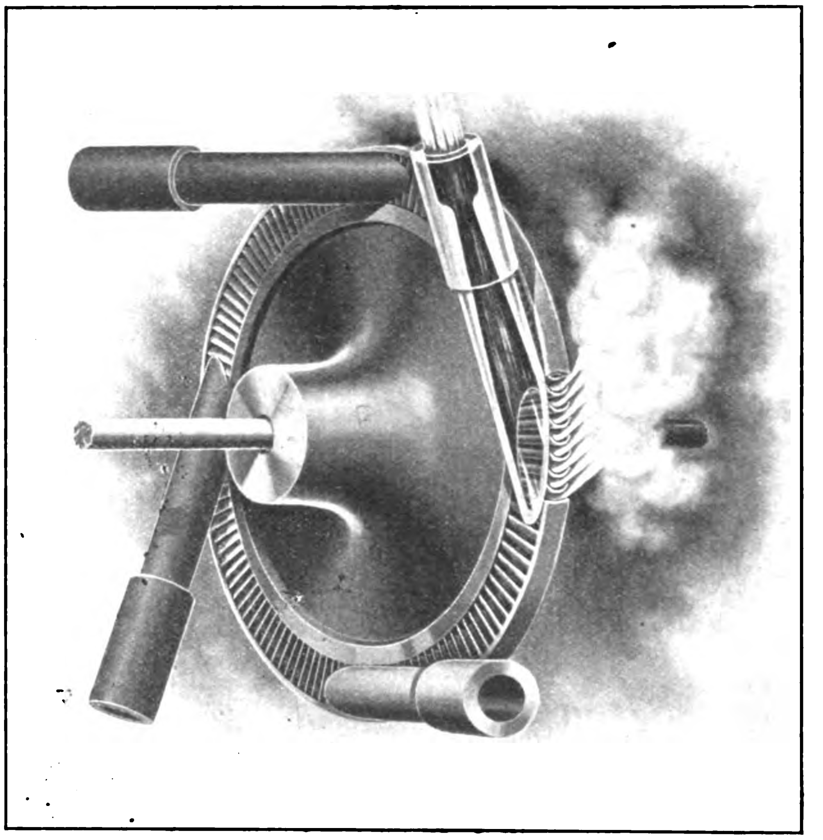
The plans for the Fort Erie electric railway extension to Chippewa have been approved of by the Ontario Government.

THE DE LAVAL STEAM TURBINE.

The De Laval Steam Turbine is a high speed rotary steam engine, in design and construction adapted for all purposes where the common reciprocating steam engine is now used. This is especially the case where great efficiency, uniformity of rotation, and close regulation are important, as when used in connection with electrical machinery, centrifugal pumps, fans, blowers, etc. Its high speed and the directness of its energy conversion decreases the dimensions and weight, and simplifies the construction without impairing its efficiency, advantages which do not exist with the modern steam engine where great bulk and complexity are features indispensable to highly efficient operation. Its principal advantages are: No leakage from wear, small friction loss, high efficiency with variable loads, no moving parts under pressure, close speed regulation, simplicity of construction, perfect balance—small foundations, small space occupied, ease of erection, automatic oiling, no danger from water and long life.



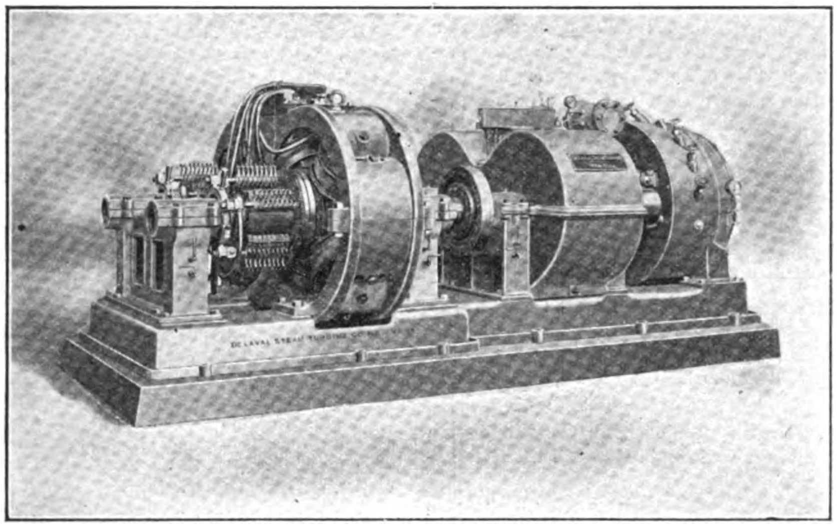
THE DE LAVAL TURBINE WHEEL AND NOZZLES.

Unlike the reciprocating engine the De Laval Steam Turbine has no stuffing boxes, no glands, no packing joints, and no working parts under pressure, which entirely eliminates the question of loss from leakage, in this respect differing from all other steam motors. The efficiency of a steam engine as given in a shop testing room may be of the very best, but after running, the leakage constantly increases and the efficiency decreases, while the turbine throughout its entire life remains absolutely constant in this respect, and a test made in the shops at the time a turbine is shipped would hold good for the same engine after a number of years of operation.

There is practically no friction loss to contend with in the turbine, while in the reciprocating engine the loss caused by poor or improperly adjusted packing and piston or valve rods worn out of parallel is often considerable, and a surprising difference in efficiency is often shown in a number of tests made with the same engine through these causes.

While the De Laval Steam Turbine running condensing will give a better efficiency than a compound condensing Corliss engine, there is the additional advantage in favor of the turbine, that the efficiency of the reciprocating engine is given for its full rated load and the steam consumption per horse power largely increases with every increase or decrease of the load, while with the turbine the efficiency is practically the same, from 25 per cent. load to a 20 per cent. overload. It is undoubtedly a fact that in nearly every case a steam engine is running under-loaded rather than overloaded throughout many of its working hours. This is particularly so with an electric light plant, where the peak of the load lasts for a very short time, and during the balance of running time the engine must necessarily be operating at a great loss, in many cases more than doubling the quantity of steam used per horse power hour. In other words, the total amount of fuel required to operate a reciprocating engine at half-load is almost equal to the quantity required for a full-load, while with the turbine the steam consumption is nearly proportionate to the amount of work being performed. Fuel cost is beginning to assume an important aspect in this country, and this, coupled with the close competition in most lines of manufacture, necessitates taking advantage of every means of fuel-saving known. Nothing offers a better opportunity for thus economizing than the De Laval Steam Turbine. It is undoubtedly the excessive cost of fuel in Europe that has led to the general adoption of the steam turbine for all classes of power work so far in advance of its introduction into the United States. While as a general proposition Americans are in the lead in machine designing and construction, it is freely admitted that in steam engine practice Europeans lead the world.*

As steam under pressure does not come in contact with any moving parts a very high pressure can be used with a considerable increase of economy. This feature is also of great importance when using superheated steam, as it removes the difficulties of lubrication at high temperatures. It is undoubtedly with superheated steam that the greatest future improvement can be looked for in the reciprocating engine, but a limit is soon reached on account of the great difficulty of lubrication. With the De Laval Steam Turbine the saving is equally as great, with this difference, that the allowable temperature and pressure is entirely a question of the steam boiler used and is not in any way limited by the turbine.



Direct Current Turbine Dynamo.

The speed regulation is unexcelled. The high speed, the simple and direct connection of the governing mechanism, and the exceedingly sensitive governor insure a perfect, and under all conditions, safe control of the speed of the turbine, at the same time keeping the variation within very small limits. The value of this cannot be over-estimated, especially where a machine is used for driving electrical apparatus, where the full load is often thrown off or on at once, a happening which has proven destructive to many a steam engine. The De Laval Steam Turbine is particularly adapted for operating alternating machines in parallel, as there is an entire absence of variation in angular velocity, which is responsible for so much trouble with reciprocating engines.

The entire absence of reciprocating motion and the light weight and perfect balance of all revolving parts removes the necessity of foundations, except such as are required to sustain the weight of the larger sized machines, and as this is much less than the weight of reciprocating engines of the same capacity the saving in cost of foundations is an important item. In the smaller sizes no foundations whatever are necessary, and turbines of any size may be placed in the upper stories of high buildings without any preparation other than strength enough to sustain the dead load.

As compared with a steam engine of equal power the space occupied and the weight of the turbine is extremely small. A large part of the metal in a reciprocating engine is used to absorb the shock, which is entirely absent in the turbine, but a sufficient quantity of metal is used in the turbine wherever necessary to withstand any strains it may be called upon to resist, and a large factor of safety is allowed. The saving in space occupied, in cost of building, in transportation and in erection, as well as weight and cost of repairs when needed, are items well worth considering.

The main shaft and dynamo bearings are ring oiling and require no attention other than an occasional refilling with oil. The bearings on the turbine shaft are fed from a common reservoir holding enough oil for a day's run, and a receptacle is provided in the base which collects all of the drip oil. This can be filtered and used over and over again. The oil reservoir is a closed one and can be connected with an elevated tank. By pumping the drip oil to tank after passing through a filter the system becomes automatic. The quantity of oil under all conditions is much less than that consumed by a steam engine. No cylinder oil is used and there is no oil in the exhaust steam, which makes the turbine particularly well adapted for use with a surface condenser or open heater, or where it would be advantageous to return all condensation to the boiler.

There is absolutely no danger from water being carried over into the motor as there are no valves and no clearance spaces where damage could result, the only effect of a large body of water being a slight slowing down of the wheel until it is disposed of. It is well, however, in all cases to use a separator close to the governor, as wet steam slightly decreases the efficiency of the turbine.

An experience extending over a period of about eight years, during which time there have been placed on the market from the European factories upwards of four thousand steam turbines, has demonstrated that the wear in every case is very much less than any reciprocating engine. Some of these machines have operated during the entire time with practically no repairs, and at the most it has been only a matter of renewing some interchangeable babbitt bearings which can be removed or replaced without lifting the turbine shaft or the gear shaft from its position, and in an extremely short space of time. Unlike another well-known make of turbine there are no studs or pins about the governor or any other part of the De Laval turbine; these always give more or less trouble, and in the governors and valve motions of all types of reciprocating engines where the centrifugal force makes them difficult to lubricate, they are soon worn flat on one side. There is no valve motion to wear, as in the steam engine, or to cause excessive friction and consequent loss in efficiency, which is a considerable item even in the best so-called balanced valve engine.

The De Laval Steam Turbine is particularly well adapted for direct connection to dynamos, centrifugal pumps, blowers, fire engines, etc. All such units are built and tested in the works, which is a decided advantage over the old method of buying an engine from one place, a generator or a pump from another, and having them fitted together on the ground where used, often-times with great expense and delay and probably a poor piece of work as the result. All machines are ready when taken from the car to be set down and operated when convenient, nothing being necessary but the connection of steam and exhaust, and switchboard connections in case of dynamos.

High speed, while objectionable in some classes of machinery, is certainly not in the turbine; the parts being so small, so perfectly balanced, and so well lubricated, are more durable than those of even a slow moving reciprocating engine. While the speeds used in the De Laval Steam Turbine may seem excessive when applied to a steam engine, they are common practice in other lines of work where the conditions imposed on them are more severe than with the turbine.

The De Laval Separator Company has during the last twenty years placed on the market over 250,000 centrifugal cream separators, which are running at speeds once considered absolutely out of the question, and the fact that these have been placed in operation on farms and in creameries where they are handled by the cheapest class of help, and often-times with practically no attention and almost no repairs. In addition to these many thousands of other makes have been sold and are in operation every day at speeds varying from 6,000 to 25,000 revolutions per minute. They are set up with poor foundations, or none at all, and in a number of cases where care is not taken with the engine governor, the speed even exceeds these figures. Aside from a rare accident, caused by the grossest carelessness, these machines are never heard of by the engineering public. Certainly if working under such conditions and at such speeds these separators give satisfaction, as they undoubtedly do, there should be no question in the mind of a steam user as to the durability of the De Laval Steam Turbines, with their wonderful simplicity of construction, and used as they are where all conditions are infinitely better, and where in the majority of cases they are in the hands of intelligent operators.

Exports of Electrical Material from New York.

The following are the exports of electrical material, from the port of New York, for the week ended October 16:

Antwerp, 25 packages, $1,763; Argentine Republic, 107 packages, $4,757; 2 bundles of copper wire, $62; Australia, 1,697 packages, $244,536; Berlin, 6 packages, $2,233; Bilbao, 1 package, $7; Brazil, 21 packages, $942; Bremen; 9 packages, $330; British Guiana, 9 packages, $225; British East Indies, 1 package, $30; British Possesions in Africa, 97 packages, $5,938; British West Indies, 25 cases, $359; Copenhagen, 1 case, $80; Cuba, 79 packages, $1,278; Dutch West Indies, 15 cases, $300; Genoa, 4 cases, $580; Glasgow, 27 cases, $1,292; Haarlem, 1 case, $21; Hamburg, 67 packages, $3,940; 77 cases, $3,113; Havre, 20 packages, $3,438, Hayti, 18 packages, $201; Japan, 1 case, $40; Liverpool, 222 packages, $22,791; London, 363 cases, $6,445; Manchester, 14 cases, $1,794; Mexico, 133 cases, $9,846; Milan, 2 cases, $500; Newcastle, 20 packages, $7,805; Peru, 14 packages, $838, Rotterdam, 4 packages, $55; Santo Domingo, 1 case, $14; 16 packages, $1,004; Southampton, 14 packages, $441; Tasmania, 4 packages, $1,299; U. S. Colombia, 24 packages, $1,026; Venezuela, 47 packages, $1,480.

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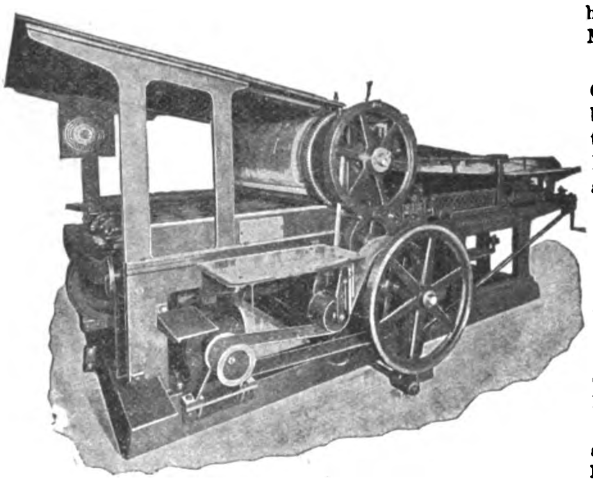
*All efficiency tests or diagrams of steam consumption for the De Laval Steam Turbine are based on the actual or brake horse power and not on the indicated. The difference in favor of the turbine in rating should be about 10 per cent.

Good Man for Export Work.

A young man who has had four years' experience in electrical engineering work, speaks Spanish and Portuguese, would like to secure employment in the export department of an electrical company. Address J. L., care ELECTRICITY.

A Modern Printing Press Equipment.

Electrically driven printing presses have been in operation long enough to demonstrate beyond question their superiority over all other kinds. They are no longer an experiment, but are considered an important factor in economy of power and an increased output. The individual equipment of each press is also conceded to be the most satisfactory, but it is sometimes a question which method—belted, geared or direct connected—gives the best results. One of the most successful is a belted equipment recently perfected by the Sprague Electric Company, and shown in the accompanying illustration. It consists of a Lundell 4 hp., standard speed, compound wound motor, belted to a flat bed press.



The motor is controlled by one of the Sprague Company's standard rheostatic rotary controllers, used in connection with armature and shunt field regulating resistances. The pulley on the motor is 4½″ diameter and 6″ face, and the pulley on the main driving shaft of the press is 22″ diameter, 6″ face. The transmission of the power from the motor to the press is obtained with a medium thickness perforated endless belt 5½″ wide, which insures noiseless operation and reduces slippage to a minimum. An idler or belt tightener is used which, together with the motor brackets, are furnished and attached by the press manufacturer. This method of equipment has merit, owing to the impossibility of sudden strains being put on the gears of the press or the motor by the rapid manipulation of the controller. With this equipment, if the controller suddenly throws the full power upon the motor, it causes a slight slippage of the belt until the press has attained its speed.

The motor is attached to a removable bed plate which permits the motor, in case of accident, to be withdrawn and another substituted while repairs are being made. This equipment has the additional advantage of being an economical installation.

Card from Chas. A. Schieren & Co.

We have just received word from Buffalo that we have been awarded a gold medal at the Pan-American Exposition, for the superiority of our oak bark tanned leather belting and belt leather. Our exhibit there was in the machinery section, and it consisted of an oriental kiosk, made from the same material that the Exposition buildings were made, one of the artistic features of the decoration being the wainscoting reaching from floor to ceiling on all sides, and made from samples of leather belting, showing the various grades of leather and fastening at laps of belting used by our house. The exhibit proper consisted of a 72″ 3-ply leather belt, 165 feet in length, made for the People's Tramway Company of Putnam, Conn., which is undoubtedly the largest 72″ belt ever made in this country. In addition to this large belt, we exhibited rolls of smaller sizes, showing the different grades manufactured by us, and in the electric power plant of the Exposition we have had a 20″ double and 7 or 8 12″ double leather belts running ever since the Exposition began. These belts are treated with Leatherine, a composition which renders belts impervious to dampness and water and gives the belt more dynamic power than a belt which is not so treated. A practical demonstration of the value of Leatherine occurred during the heavy storm recently, when the roof of the Exposition power house leaked and wet all of the belts in operation. The only belts that held together at the laps and were not rendered useless were those made by ourselves filled or dressed with Leatherine.

Yours respectfully,
CHAS. A. SCHIEREN & CO.

PERSONAL MENTION.

Mr. W. Kelsey Schoepf, of Pittsburg, was recently made president of the Cincinnati, O., Traction Company.

Mr J. B. Hanna, of Cleveland, O., will devote his entire time to the various interests of the Everett-Moore Syndicate.

Mr. M. Tietjen, the noted financier, died in Copenhagen, Saturday, October 19. He started many banks, railroads and industrial companies, among them being the United Steamship Company and the Northern Telegraph Company, whose lines extend across Asia.

INCORPORATIONS.

The Oakland City Electric Light & Power Company, Indianapolis, Ind. Capital stock $15,000. Directors: George H. Klenck, Charles Haury and Charles J. Haury.

The Corona Gas & Electric Company, San Francisco, Cal. Capital stock, $50,000. Incorporators: J. G. Whitson, A. Harris, H. M. B. Pabst, L. M. Thompson and P. L. Benjamin.

The Cresset Company, New York City—to do stereotyping and electrotyping. Capital stock, $4,500. Directors: J. T. Harper, New York City; J. A. Farrington, Jr, and Landon Gurlitz, Brooklyn.

The Montana Electric Company, Butte City, Mont. Capital stock, $100,000, Incorporators: Max Heebgen, W. T. Jackson and H. W. Turner.

The Hubbell Grier Electric Company, New York City. Capital stock $25,000. Directors: Harvey Hubbell and E. R. Grier, Bridgeport. Conn., and F. E. Laimbeer, New York City.

The Mound City Motor Company, St. Louis, Mo. Capital stock $2,000. Shareholders: John J. Mielko, Edward M. Doyle, George W. Bonney and M. J. H. Perkins.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCT. 15, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

684,408. Trolley Attachment. Thomas J. Burke, New Orleans, La. Filed July 1, 1901.

684,596. Electric Railway. Benson Bidwell, Philadelphia, Pa., assignor of one-half to Charles F. Bidwell, Indianapolis, Ind. Filed Aug. 14, 1884.

684,600. Electric Rail Bond. Israel B. Chantler, Sewickley, Pa. Filed Jan. 16, 1901.

684,609. Controlling System for Railway-Vehicles. Ernest R. Hill, Wilkinsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Filed Sept. 20, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

684,407. Electric-Arc Lamp. Hugo Bremer, Neheim, Germany. Filed Nov. 2, 1900.

684,493. Process of Making Incandescing Mantles. Woodbridge H. Birchmore, Brooklyn, N. Y., assignor of one-half to Clarkson A. Collins, New York City. Filed March 14, 1900.

684,534. Inner Globe for Inclosed-Arc Lamps. James P. Williams, New York City, assignor to H. Howard Douglas, same place. Filed Nov. 10, 1900.

684,619. Electric-Arc Lamp. Charles M. Shafer, McDonald, Pa., assignor of one-half to Joseph Voye, Sr., same place. Filed June 26, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

684,579. Means for Operating Electrical Machines Synchronously. Carl J. A. Michalke, Charlottenburg, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill., a Corporation of Illinois. Filed Dec. 31, 1897. Renewed March 1, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

684,445. Telephone-Attachment. Horace J. Mier, Rutherford, N. J. Filed May 14, 1901.

684,506. Telephone-Relay. Bela Gati, Temesvar, Austria-Hungary. Filed March 22, 1900.

684,601. Telephone Apparatus and System. Frank B. Cook, Chicago, Ill. Filed April 13, 1898.

684,602. Apparatus for Telephone Systems. Frank B. Cook, Chicago, Ill. Filed April 17, 1899.

684,615. Telephone Call-Bell Apparatus. William S. Paca, Erie, Pa., assignor of one half to Peter H. Adams, same place. Filed Dec. 26, 1900.

684,706. System of Signaling. Arthur J. Mundy, Boston, Mass., assignor to the Gray Telephone Company, Waterville, Me., and Boston, Mass. Filed April 5, 1901.

MISCELLANEOUS.

684,415. Quadruplex Telegraphy. Clark E. Diehl, Harrisburg, Pa., assignor to the Postal Telegraph Cable Company of New York. Filed Feb. 25, 1901.

684,429. Visual Indicator for Submarine Boats. John P. Holland, Newark, N. J., assignor to the Electric Boat Company of New Jersey. Filed Sept. 27, 1900.

684,440. Signal-Telegraph. Erwin Lavens and Edward J. Lavens, Brooklyn, N. Y. Filed Jan. 7, 1901.

684,459. Electric Heater. Edwin F. Porter, Boston, Mass., assignor to the Bay State Electric Heat & Light Company, Jersey City, N. J. Filed Jan. 29, 1898.

684,467. Wireless Telegraphy. Harry Shoemaker, Philadelphia, Pa., assignor to Marie V. Gehring, same place. Filed Feb. 12, 1901.

684,482. Clutch for the Transmission of Power. Harry E. Walters, Westminster, Eng. Filed Oct. 1, 1900. Renewed July 6, 1901.

684,535. Motor Vehicle. Edward T. Birdsall, New Rochelle, N. Y., assignor to the Desberon Motor Car Company, New York City. Filed July 29, 1901.

684,541. System of Testing Coils. Roger W. Conant, Boston, Mass. Filed Jan. 7, 1901.

684,612. System of Electrical Distribution. Carl J. A. Michalke, Charlottenburg, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill., a Corporation of Illinois. Filed Dec. 31, 1897.

684,628. Electric Resistance. Wilber A. Carrell, West Homestead, Pa., assignor of one-half to John O. Horning, Pittsburg, Pa. Filed June 21, 1901.

684,641. Insulator for Storage-Battery Plates. Charles S. Kaufmann, Chicago, Ill., assignor to the American Battery Company, Chicago, Ill. Filed Jan. 7, 1901.

684,642. Plate for Storage Batteries. Charles S. Kaufmann, Chicago, Ill., assignor to the American Battery Company Chicago, Ill. Filed June 9, 1901.

684,643. Plate-Holder for Electric Storage Batteries. Charles S. Kaufmann, Chicago Ill, assignor to the American Battery Company, Chicago, Ill. Filed Jan. 10, 1901.

684,695. Process of Electrically Connecting Platinum Wires or Sheets With Non-Metallic Bodies. Richard Kuch, Hanau, Germany. Filed Nov. 24, 1899.

684,697. Storage Battery for Boats. Robert M. Lloyd, New York City, assignor to the Electric Boat Company of New York City, a Corporation of New Jersey. Filed June 14, 1900.

684,698-684,699-684,700. Storage Battery. Robert M. Lloyd, New York City, assignor to the Electric Boat Company, New York City, a Corporation of New Jersey. Filed Nov. 27, 1900, Feb. 15, 1901.

684,725. Means for Controlling Energy Delivered to Translating Devices. Joseph Sachs, Hartford, Conn. Filed March 9, 1900. Renewed Feb. 28, 1901.

THE TELEPHONE WORLD.

To Change Telephone Service.

The butchers and grocers of Columbus. Ind., have entered into an agreement to discontinue the use of the Bell telephone at their places of business, at the expiration of their contracts. This matter has been under consideration for some time, and took definite shape at a recent meeting. A committee was appointed to see each grocer and butcher and secure his signature to a contract agreeing to use only the Citizens' telephone. This work has been completed, and, as far as is known, all the butchers and grocers have signed the agreement.

Several of the merchants have been seen and each one reported that the Bell telephone will be taken out. They give no reason for this move except that they are able to reach most of their customers over the Citizens' system, and that they intend to cut their expenses.

Manager May of the Bell Company says that nearly all of the 31 grocers will use the Bell 'phone and that most of the butcher shops can be reached by his lines.

The Bell Telephone Company has about 300 subscribers in Columbus, and very few in the rural districts, which is considered a disadvantage to the merchants. The Citizens' system has nearly 500 'phones in that city, and nearly that many more lines extending into different parts of Bartholomew County. Another meeting of the merchants will be held, when final action is to be taken.

A party of Eastern capitalists has lately been in Bloomington, Ill , negotiating for the purchase of the Home or Independent Telephone Company, which has been in operation there for several years, and now has 700 instruments in use. The company was organized to secure competition with the Bell, but has never had the money to put in as good service as the Bell. It is said the Home is paying a fine interest. The deal includes the toll lines of the McLean County Telephone Company, which runs to all the towns and villages and many of the private houses in the county.

A telephone line is being built from Mintonville to Humphrey, where it will make connection with the Middleburg, Ky., lines. The latter place will, when the line is completed, be in telephone communication with Somerset and Southern Kentucky and East Tennessee towns, as well as with Louisville, Lexington and all points throughout Central and Northern Kentucky.

A report from New Haven, Conn., states that the Southern New England Telephone Company will increase its capital stock $230,000, raising its total of outstanding capital stock to $2,990,000. The new stock will be issued at par, and will participate in the next July dividend. The money is to be used in liquidating the floating debt incurred by the extension of the plant.

The Richmond, Va., Telephone Company will shortly petition the common council for an amendment to its charter, allowing the maximum rate per annum for the use of the telephones of the company to be changed from $36 to $72. This latter figure is the rate fixed by the Bell Telephone Company. The concession, it is thought, will be readily granted. John C. Robertson, president of the Richmond Telephone Company lately said: "We have made arrangements to install the finest plant to be had, and I can assure you that we will give the Bell Company about as lively a fight here in Richmond as it has ever had to contend with."

The Eel River Telephone Company, newly organized at North Manchester, Ind., has awarded contracts for an up-to-date local exchange, and will build toll lines to surrounding towns. The public is likely to be benefited by competition.

The annual meeting of the Heath, Mass., Telephone Company was held last week. The directors were given power to sell any portion of the line in Heath or Charlemont that they wish. It was voted to increase the capital stock from $12,000 to $18,000.

News received from Aberdeen. S. D , asserts that stockholders of the Dakota Central Telephone Company have authorized an increase of the capital stock from $100,000 to $500,000. The new stock will be issued as fast as needed for improvements and extensions. The stock has been selling at 25 cents premium.

The farmers between Kenyon and Aspelund, Minn., have organized a Farmers' Mutual Telephone Company, and will build a line connecting these two points this fall. Their intention is to extend the line from Aspelund to Zumbrota.

A telephone line has been built from Hazard to Jackson, Ky , by citizens of Hazard, and the venture is proving a success.

The Wallkill Telephone & Construction Company, a Middletown, N. Y., corporation, filed its incorporation papers a short time ago. The object of the company is to construct a telephone line connecting a number of surrounding villages with Middletown. On the south it will extend to Slate Hill, Johnson's, Unionville, West Town and Sussex, where it will connect with the Port Jervis local company. On the north and west it will extend to Otisville. The present line to Bullville will also be extended to Pine Bush and eventually connected with Newburg by way of Midway Park, Campbell Hall, Montgomery and Walden, where it will meet the existing line from Newburg. The incorporators are George William Batton, T. D. Mills, Wm. Snyder, Floyd W. Morgans, W. A. Marshall, Geo. E. Beakes, D. B. Hardenbergh, John McWilliams, Thomas C. Rogers, J. E. Barnes, M. A. Stivers, Chas. Higham and Jas. G. Harding. The capital stock is $12,000. The company will advertise for bids and push forward the work of construction as rapidly as possible this fall.

The summer's work in the northern division of the New England Telephone & Telegraph Company, which is under the direction of Superintendent J. K. Butler, of Burlington, Vt., is nearly completed. The work this year has been confined largely to the improvement of various exchanges, although many miles of poles and wire have been erected. During the past nine months 94 miles of poles have been set up, in which distance 3,700 poles have been used. There have been 700 miles of iron wire and 443 miles of copper wire strung. Cables have been used to a considerable extent and 7,110 feet have been put up. This is all 30 pairs cable and the length of the wire conductors is 42 660 feet. About three and one-half miles of cable have been ordered for the underground work in Burlington and the conductors in this will reach a total length of 508 miles. The longest lines built this year were double copper circuits between Montpelier and Bellows Falls and Claremont and Bradford. The remaining lines were for shorter distances.

The directors of the Mankato, Minn., Citizens' Telephone Company have been talking over plans for the future. The plant is growing all of the time, and is approaching the limit of present accommodations. The directors are contemplating making important changes next spring or summer that will greatly increase the facilities for business. The company has connected up with the farmers' line at Lura Lake, by way of Delavan. Negotiations are on foot looking to connecting with the Sterling-Amboy independent line. The line from Mapleton to Good Thunder is completed and the section from Good Thunder to Garden City will be put in as soon as possible. The company already has a line to Garden City, so that the entire southeastern part of the county will soon be connected up.

According to news received from Duluth, Minn., the life-saving station on Minnesota Point is now equipped with a telephone after a long effort on the part of Capt. McLennon. The Duluth Telephone Company installed the instrument on the order of the War Department. Since the establishment of the station the work has been seriously handicapped for want of rapid communication with the scene of accidents, tug or other whistles alone being available. These will now be supplemented by the telephone.

Articles of incorporation of the Kentucky Telephone Company were recently recorded in Covington. The incorporators are Wm. Scheifers, John S. McCormick, Michael Glore and J. J. Weaver. The capital stock is $5,000. The business of the corporation will be the erection and maintenance of poles, wires and other electric appurtenances for telephone, telegraph, police, messenger and fire alarm lines. The office will be located at Ludlow, Ky.

The directors of the Ashtabula, O., Telephone Company held a regular meeting this month and transacted considerable business. The most important was the declaring of a 3 per cent. semi annual dividend, payable November 1. The affairs of the company are in excellent shape.

C. C. Crowe, late manager of the Cumberland Telegraph & Telephone Company at Bay St. Louis, Miss., has been placed in charge of the company's exchange in Crowley, La., vice M. A. Foute, who has been recalled by the company to New Orleans.

It is reported that the local telephone company at Meridian, Miss., has sold out to the Cumberland Telephone Company.

The new State Telephone & Telegraph Company is building from Odebolt to Sioux City, Ia.

Hillyard, Wash., now has a telephone exchange.

Among the recent property transfers at New Iberia, La., is that of the Louisiana & Texas Long Distance Telephone Company, Limited, to the Telephone Company of America of Washington, D. C , for a consideration of $35,000 cash. The new company is at present trying to secure a permit from the city of New Orleans. The management remains the same—that is, R. F. Hogsett has been made manager for everything outside of New Orleans. A good deal of work has already been done toward getting things in shape for the new company, and the materials for wiring Crowley, Lafayette, New Iberia and Franklin have already been ordered. The work of installing the new system will shortly begin. As soon as a permit is secured in New Orleans, that city will also be equipped with the new system.

The Independent Union Telephone Company, which has made its application for the franchise for the city of Buffalo has been in the business of installing telephone systems for the last eight years. It has systems in several towns in Ohio, and has been organized under the laws of the State of New York, and is capitalized at $2,500,000. It has installed or is installing plants at Dunkirk, Fredonia, Batavia, the two Tonawandas, Lockport, Gasport, Medina, Albion and eight other towns around Albion, with an up to date telephone service. The company started not a year ago at Niagara Falls with 100 'phones and now has over 600, and the number is increasing daily. This is also true as to the Tonawandas and Lockport.

The Electrical Investment Company, capitalized at $100,000, has been organized by Ft Wayne, Ind., capitalists for the purpose of building independent telephone lines in Indiana cities. Exchanges at Muncie and Elwood are already projected and franchises applied for.

The Weston (O.)-Grand Rapids, Telephone Company is beginning to set the poles to extend its lines into Liberty and Jackson townships, reaching the villages of Wingston, Haney and Hoytville. President Bamer is at present personally superintending the work.

The Rock Island, Ill., city council is wrestling with the question of two independent telephone companies, there being a proposition from a Pennsylvania party, as well as that of Bills & Wortham The latter is still pending and is the subject for discussion at a conference of the local interests.

Wire thieves have begun to operate again in the southern section of New Jersey, and the Bell Telephone Company has suffered considerable loss in consequence of their work. The line between Burlington and Riverton has been stripped of about 100 pounds of copper wire.

Stockholders of the Central Union Telephone Company of Chicago have voted to reduce the capital stock to $3,481,500, or half the old amount, in accordance with the recommendation of the board of directors.

After a meeting that lasted far into the night, the aldermen voted for telephone competition in Buffalo, N. Y., and by a vote of 24 to 1, decided in favor of awarding the franchise to the Frontier Telephone Company (independent).

The Michigan Telephone Company reports a net gain of 615 subscribers in September, and a net gain of 6,331 since January 1, making a total number of 50,870 subscribers on September 30.

The Rome, N. Y., Home Telephone Company closed its first year September 30, 1901, with a total of 635 'phones duly installed and giving satisfactory service.

The Rochester, Minn., Telephone Company is branching out into all parts of Olmstead County, and has 50 subscribers on its branch lines.

The South Whitley, Ind., Telephone Company has increased its capital stock from $3,000 to $15,000.

The Consolidated Telephone Company will build a line to Philippi, Bellington and Elkins, W. Va., within 60 days.

TELEPHONE INCORPORATIONS.

The Green Springs Telephone & Electric Company, Green Springs, O. Capital stock, $15,000. Incorporators: E. L. Johnson and others.

The Woolstock Telephone Company, Woolstock, Ia. Capital stock, $5,000. Officers: C. H. Clifton, M. Wallin, J. C. Smith and J. N. Omstood.

GENERAL ELECTRICAL NEWS.

Lighting.

Alton, Ill.—A few business men are agitating the movement to establish an electric light plant here.

Altoona, Pa.—A new electric light company is being organized in this city, projected by Messrs. Carl Ormes, S. S. Reighard and A. R. Wolfe. The concern promises to rival the Edison Company, operating an extensive plant here at present without competition.

Bellefontaine, O.—The Bellefontaine Hame & Tool Company expects soon to construct an electric light plant of its own in its factory in the west end of this city.

Braddock, Pa.—The Keystone Electric Company, composed of capitalists of this place, will begin this week the erection of an electric light and power plant.

Burlington, Ia.—The electric light plant was recently damaged by a severe wind and rain storm.

Calumet, Mich.—A municipal electric lighting plant is being talked of and it is said the aldermen are in favor of uniting with Red Jacket to establish a plant for this place.

Casey, Ill.—This place is to have a city light plant with a capacity of 50 arc lamps.

Columbia, Pa.—C. C. Kauffman lately purchased the Columbia Electric Light & Power Company for $70,000. This company has a monopoly of all the electric lighting of this city. This month Mr. Kauffman sold the property to the Lancaster County Railway & Light Company, which will enlarge and improve the plant.

Concord, N. C.—The Coleman Manufacturing Company will install new machinery, electric light plant, etc.

Conshohocken, Pa.—There is a strong probability that a borough electric plant will be erected in this place by the town council to supply illumination for the streets.

Deerfield, N. Y.—Deerfield Corners is soon to have an electric light plant.

Dexter, N. Y.—There are prospects of an electric plant for lighting purposes if the citizens manifest sufficient interest.

Eufaula, I. T.—L. J. Mittinger will erect electric light and ice plants and construct a system of waterworks.

Florence, Ala.—The mayor and board of aldermen have granted a franchise to M. C. Buxbaum and associates for an electric light, power and heat plant and electric street railway for this city.

Fort Benton, Mont.—Causey Brothers of the electric light company have sold the plant to a stock company, which filed articles of incorporation. H. J. Causey, Chas. Causey, C. E. Duer and others are the incorporators.

Franklinton, N. C.—This place is to have electric lights and waterworks.

Highland, Ill.—The electric light question is shortly coming up in the city council meeting.

Hutchinson, Kan.—The city council has decided that the city should own its waterworks and electric light plant.

Jackson, Ga.—A franchise has been granted to the Jackson Street Railway & Electric Light Company for the construction of an electric road and electric plant for lighting purposes, and for furnishing power to manufacturing plants. Capt. W. F. Smith, general manager of the Flovilla & Indian Springs Railroad of Flovilla, Ga., has charge of the construction of the road.

Kingston, Ont.—As a result of arbitration the price fixed for the city gas and electric light plants may be $260,000 to $280,000. The city may buy the works.

Pennington, N. J.—The Pennington Improvement Society is in favor of electric lights.

Richmond, Ind.—The Wayne County infirmary will be lighted by electricity.

Royal Centre, Ind.—An electric light plant is to be installed at this place.

Vernal, Utah.—This place will in all probability be lit with electricity in the near future. Contracts for the plant are already under consideration. James Johnson is the promoter of the enterprise.

Waco, Tex.—This city will build waterworks and electric plants. Plans and specifications are not yet ready. J. W. Riggins, mayor.

Street Railways.

Asheville, N. C.—It is stated that the work of constructing the electric railroad between Weaverville and Burnsville will be commenced in the near future. It is being promoted by the Asheville and Weaverville Street Railway Company, which has prepared to float bonds to the extent of $160,000. L. B. Wilford of this city is interested.

Auburn, N. Y.—A practically new power house will be erected on the site now occupied by the old structure by the Auburn City Railroad Company. It is intended to generate all the power for the Interurban Railroad from this city to Syracuse. The voltage will be increased to 15,000. The alternating current will be run to sub-stations, one between Skaneateles and Marcellus and the other near Syracuse.—The directors of the Auburn Interurban Electric Railroad Company have voted to increase the capital stock of the company from $250,000 to $1,000,000.

Brunswick, Me.—There now appears to be some chances that the proposed extension of the electric road from Brunswick to Yarmouth, making a through road from Lewiston to Portland, may be built next spring.

Canal Dover, O.—A new electric line will be built between the twin cities and New Comerstown. A company has been incorporated for the purpose. The line will pass through Tuscarawas, Gnadenhutten and Lock Seventeen.

Carson City, Nev.—Incorporation papers have been filed with the Secretary of State of a company to utilize the power of Clear Creek to run an electric road from this city to Lake Tahoe. A new plant has been completed near Winnemucca.

Cedar Rapids, Ia.—It is stated that R. A. Hall of this city is promoting a scheme to build an electric railway between Oskaloosa and Tama.

Glassboro, Pa.—The extension of the trolley road to this section is again being agitated by the citizens, with the board of trade of this place leading the movement.

Jefferson City, Mo.—It is reported that George H. Monah n is interested in a company recently organized to construct an electric street railway in this city and suburbs.

Lake Charles, La.—It is reported that the Lake Charles Street Railway Company will rebuild its line for the use of electric motors, and make several extensions. Adolph Meyer is one of the directors.

Lexington, Ky —An electric railway system will be constructed between this city and Versailles. The Blue Grass Rapid Transit Company is interested.

New Haven, Conn.—The New Haven Railroad Company has from time to time been having considerable difficulty in the operation of its third-rail line between Hartford and Bristol, owing to the inadequacy of the current. This is to be remedied by the refitting of its power house at East Berlin, by a new feed wire, and by new sub-stations at Hartford and Bristol.

Newark, O.—The Columbus, Newark, Zanesville & Wheeling Electric Railway Company of this city has been capitalized with $150,000.

Portsmouth, Va.—The Norfolk, Portsmouth & Newport News Railway Company is considering an extension of its trolley system to Churchland.

Rosedale, Kan.—The State charter board has granted a charter to the Kansas City & Olathe Electric Railway Company with a capital stock of $1,000,000. Headquarters will be established here. T. C. Goodwin, T. A. Milton and others are interested.

Scranton, Pa.—Dr. G. E. Hill of this city is organizing a company to build a trolley line from here to Lake Ariel, a distance of 25 miles.

Sioux City, Ia.—The promoters of the proposed electric railroad from this city to Le Mars have enlarged their plan and now propose to construct the line to Spirit Lake. The total length of the line will be 90 miles. The route to Spirit Lake from Le Mars will be by way of Primghar and Hartley.

Manufacturing.

Baltimore, Md.—The Monarch Electric Company was recently incorporated by Messrs. Walter Raymond Carpenter, Raleigh T. Lilley, Frank M. Walton, Clarence D. Boyle and Thomas Ireland Elliott for the purpose of manufacturing and dealing in electrical supplies and appliances, with a capital stock of $2,000.

McKeesport, Pa.—Samuel H. Weimer, of Boston, near this city, who recently received a patent on a cement conduit for electric and telegraph wires, has formed a company composed of McKeesport and Greensburg capitalists, and will erect a plant near here on the Youghiogheny River front, which will cost about $50,000, and will employ nearly 150 men. The new works will be in operation before next spring.

St. Louis, Mo.—Articles of incorporation were lately filed by the Hill Electrical Manufacturing Company. The capital stock is $25,000, paid. Harry M. Hill, W. P. Foster and Morton Jordan are the stockholders.

Trenton, N. J.—The Colonial Electric Company proposes building and operating electric railways anywhere except in this State, but is privileged to manufacture and equip telephone and telegraph lines in New Jersey. Its authorized capital is $100,000.

Company Matters.

Coshocton, O,—The Coshocton local electric company has been given a franchise by the council of this place, and will soon begin the construction of a heating plant.

Houghton, Mich.—A meeting of the stockholders of the Peninsula Electric Light & Power Company is to be held, when the matter of increasing the capital stock of the corporation will be discussed and very likely some action taken.

Power and Transmission.

Baker City, Ore.—William Pollman and a number of other men of this city have filed on the waters of Rock Creek, and have announced their intention to establish a power system for the generation and transmission of electric power to this city, to run mills and factories and light the city. The company, which is to be formed by Mr. Pollman and his associates, will expend about $50,000 on the power plant. It expects to have from 2,000 to 5,000 hp. to distribute.

Canton, O.—M. Spitzer is taking figures for an electric power plant to be built here for the Canton-Akron Electric Street Railway Company at a cost of $55,000.

Clyde, N. Y.—Charles A. Lux of this place is about to organize a company which will utilize the water power for generating electricity. A wire carrying a voltage of 20,000 will transmit the current to Syracuse in the same manner as electric power is now sent from Niagara Falls to Buffalo.

Reno, Nev.—A company has been formed here to tap the wires of the electric power company and distribute energy throughout the town for lighting, heating and power purposes.

Salt Lake City, Utah.—The county commissioners have decided to grant to A. L. Woodhouse, for the Hercules & Telluride Consolidated Power Companies, a franchise to extend the electric transmission line to Bingham for the purpose of supplying the town with commercial lighting and current for power purposes.

Mines.

Deadwood, S. D.—The Mystic Electric Chlorination Plant has started up again with doubled capacity, now being able to treat 150 tons of ore daily.

Automobiles.

Pierre, S. D.—The Standard Motor Vehicle Company, with a capital of $500,000, was lately incorporated here. R. M. Wiles, J. C. Edgecombe and T. F. Estes are back of the concern.

West End, N. J.—The New Jersey Electrical Vehicle Company has moved its Sea Bright plant to this place.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, October 21, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	35	37
Broadway and Sevénth Avenue	100	246	250
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	157¼	157¾
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	117¼	117½
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	107	108
Brooklyn City Railway	100	240	242
Brooklyn Rapid Transit	100	60	60¼
Baltimore United Railways, com	50	16½	16¾
do. do. do. pref.	50	91	92
Buffalo Railway	100	110	111
Cleveland City Railway	100	114	115
Cleveland Electric Railway	100	85	85¼
Columbus (O.) Street Railway	100	46	48
Jersey City, Hoboken and Paterson	100	19½	20¼
New Orleans City Railway, com	100	29	31
do. do. do. do. pref	100	104	107
North Jersey Street Railway	100	23	25
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	30	34
do. do. do. pref	100	85	86
St. Louis United Railways, com	100	25⅞	26
do. do. do. pref	100	79¾	80¼
United Electric of New Jersey	100	17½	20
PHILADELPHIA.			
American Railways	50	40¾	41
Citizens	50	359½	360
Columbus Railway	100	46	48
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	65	67
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23⅜	24
do do pref	50	62	62½
Dayton Traction	100	156	156¼
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151¼
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205½
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	95⅞	96
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	27¼	28
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	178½	179
West End Street, com	50	94	94¼
do. do. do. pref	50	112	113
CHICAGO.			
City Railway	100	200¾	201
Lake Street Elevated	100	11½	11¾
North Chicago	100	190	200
nion Traction, com	100	17¾	18
do. do. pref	100	58	60

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23⅛	23¼
do. do. do. pref	50	64	64¼
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	49	50

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Electric Boat, com	100	20	23
do do pref	100	45	50
Electric Lead Reduction	100	2¾	3
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	1½	3
do do pref	100	3	5
General Carriage	100	⅞	1
General Electric	100	256	256½
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	250	251
General Electric	100	256	256½
Massachusetts Electric Companies, com	100	35⅝	36
" " " pref	100	92	92½
Westinghouse Electric & Mfg., com	50	70½	72½
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	165	165½
National Carbon, com	100	18⅞	19
do do pref	100	83	85
PHILADELPHIA.			
Electric Company of America	50	6⅝	6¾
Electric Storage Battery, com	100	63	68
do do do pref	100	63	68
General Electric Automobile	50	½	⅝
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1½
do do do pref	50	1	1½
Philadelphia Electric trust ctfs. $5 paid	25	5	5⅛
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	93	94
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
BOSTON.			
American Telephone & Telegraph Company	100	159½	159⅝
Erie Telegraph & Telephone Company	100	35	35¼
New England Telephone Company		134¼	134½
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co.	100	105	110
Commercial Cable Company	100	180	185
Franklin Telegraph Company	100	45	54
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	116	118
Mexican Telephone Company	100	2	2⅛
New York & New Jersey Telephone Company	100	168	170
Pacific & Atlantic Telegraph	25	78	85
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		91½	91⅝
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	116
Cumberland Telephone & Telegraph Co	50	136	140
Chesapeake & Potomac Telephone Company	100	60	65
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		75	76
Hudson River Telephone Company	100	110	115
Northwestern Telephone Company, guar	50	124	126
Providence (R. I) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Oct. 21.

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1¼	1⅝
Eddy Electric Manufacturing Company	25	8	8¼
Storey General Electric	10	12	13
Consolidated Car Heating	100	55	57
Standard Underground Cable	100	218	220
Pratt and Whitney, pref	100	90	95

STREET RAILWAY BONDS.

	Last Sale.	Int. Paid.
ALBANY.		
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	108¼	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent.	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117½	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅝@16¾c.; Lake, 16¾@17c.; casting, 16⅛@16¾c.

Rochester, Minn., has voted to issue $25,000 electric light plant bonds.

The Trinidad Electric Company, Limited, is in the American market for about $1,000,000 worth of equipment.

The stockholders of the Third Avenue Railroad Company will hold their annual meeting in this city on November 4.

The mining interests of Barney McCaffrey in Southern Carbon County, Wyoming, will be consolidated and a $3,000,000 trolley system will connect them.

The Hudson River Telephone Company has declared its regular quarterly dividend of 1¼ per cent., payable November 1. Books close Saturday and reopen November 2.

Traffic on the Metropolitan West Side Elevated Railway of Chicago for the first twenty days of October shows a gain of 11 per cent., compared with the corresponding period last year.

It is reported that the new trolley line between Wilkes-Barre and Hazleton, Pa., will really be a part of the main line of the Lehigh Valley between New York and Buffalo. All equipment is of the heaviest.

Interests associated with the Amalgamated Copper Company and their selling agent, the United Metals Selling Company, assert that assurance has been given from official sources that there will be no reduction in the price of electrolytic copper. The commercial condition, it is claimed, has grown materially stronger.

President Vreeland, of the Metropolitan Street Railway of New York, says that the earnings of the road for September increased over $112,000. He said there was no truth in a current report that the dividend on the stock would be reduced. The report in question has been heard several times of late, but has never been seriously credited.

Stockholders of the Southern New England Telephone Company will be asked at the annual meeting next January to authorize an increase in the capital stock from $2,990,000 to $5,000,000, the legal limit. The Bell Company owns 34 per cent. of the outstanding stock. The new stock will be issued from time to time as demands of the business warrant.

Information from Washington, D. C., is to the effect that 93 per cent. of the $13,400,000 of the bonds of the Washington Traction Company have been deposited under the plan of reorganization. The time for receiving the bonds has been extended until October 31. Upon the expiration of the time it is thought that the court will be asked for authority to sell the property of the company.

Directors of the Telephone, Telegraph & Cable Company of America were in session Monday concerning the steps to be taken toward extending an independent system of telephones across New England. At the close of the meeting it was said that nothing of importance was decided upon, the question of extending the company having yet to be worked out.

The Stave Lake Power Company, of Vancouver, B. C., has completed its negotiations with eastern capitalists for the financing of the property. The money for the development is being furnished by Stone & Webster, of Boston, Mass., and work will begin at once in connection with the installation of the plant. Power will be transmitted to Vancouver and New Westminster. The cost of the work is estimated at $650,000, including $280,000 for a tunnel two miles in length, dam, etc., and $370,000 for generating plant and pole line.

A gentleman well versed in Erie Telephone affairs says: "Knowing the reputation of Charles W. Morse as a trader, it is my opinion that Mr. Morse has purchased the Telephone, Telegraph & Cable Company of America not to enter into active competition with the Bell Company or to secure control of the Erie Telephone Company, but to push the construction of the Independent Telephone Companies sufficiently to enable a sale of his properties to the Bell interests at a profit."

Application was made in the United States Court at Helena, Mont., for the appointment of a receiver for the Helena Power & Light Company. The proceeding commenced in the interest of the Central Trust Company, which holds bonds of the company to the amount of $1,000,000. The court signed an order appointing H. L. Walker, secretary of the company, as receiver. The trust company is trustee for the bondholders. For some time the company has defaulted on interest on its bonds. The company owns the gas, electric light and street car plants in Helena.

It is no secret, says the Boston "News Bureau," that there has been a difference of opinion in the General Electric board on the question of capital readjustment. Under New York laws only such an amount of stock can be issued as is equaled by the actual surplus of the company. The surplus of the company at the present time is said to amount to $14,000,000, a gain of over $7,000,000 since January 1. To make full restitution to stockholders for the stock taken from them at the time the company's capital was impaired, it will be necessary that the company have a surplus of $18,000,000. It is the belief of General Electric directors that the company will be able to accumulate such a surplus by April 1. Some of the directors are desirous of restoring part of the capital stock this fall or early winter and the remainder next year, but it is said the Morgan interests think it better policy to wait until the company's surplus will permit of a complete capital restoration.

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EDITORIAL NOTES.

Healthy Telephone Competition in Sight.

The independent telephone situation in the vicinity of New York City has of late reached a very interesting stage and the various moves that are being made by Mr. C. W. Morse, who recently obtained control of the Telephone, Telegraph and Cable Company of America, are being carefully watched with no little interest by the Bell monopoly.

The Telephone, Telegraph and Cable Company of America has the right to operate in New York, New Jersey, Massachusetts, Connecticut and Pennsylvania. Without publicity the company has strung miles upon miles of wire and will shortly be ready to begin business on a large scale. There are many "constituent companies" of the corporation, the principal ones being: The Knickerbocker Telephone and Telegraph Company with a capital stock of $7,500,000. The Boston and New York Telephone and Telegraph Company, capital stock $5,000,000. The Continental Telephone, Telegraph and Cable Company, capital stock $1,000,000. The New Rochelle and Westchester Telephone Company, capital stock $150,000. The Telephone, Telegraph and Cable Company of Eastern New York, capital stock $100,000. The Anderson Telephone Company, capital stock $50,000, and the Massachusetts Telephone and Telegraph Company the capital stock of which is embraced in the $5,000,000 of the Boston and New York, Telephone and Telegraph Company. It is also rumored that Mr. Morse has practically obtained control of the Cumberland Valley Telephone Company of Pennsylvania, which is capitalized at $10,000,000 and which controls many smaller companies throughout the Keystone State.

The parent company proposes through three of its constituent companies to take immediate steps to inaugurate competition with the Bell interests in New York, as well as in Boston. That such is the case may be inferred from the following statement made by President James M. Thomas recently:

"It is the intention of the Boston and New York Telephone Company, which is one of the constituent companies of the Telephone, Telegraph and Cable Company of America, to proceed vigorously with the completion of the line between New York and Boston.

"At the New York end we have completed the line as far as White Plains, while in Boston the work has proceeded to a satisfactory extent. It is impossible to tell with any degree of certainty just when the line between the two cities will be finished, but the work will proceed without delay.

"As for the Knickerbocker Telephone and and Telegraph Company, we fully expect to be in operation in the Borough of Manhattan within twelve months, but probably only in the lower part of the city; perhaps below Eighth street. The system, however, will be rapidly extended. We shall operate through the Empire Company's subways. We intend to introduce many improvements in telephone service. For one thing all our transmitters will be of the long distance type."

From the above it would certainly seem as though the East was about to realize the benefit to be derived from a healthy telephone competition, which has done so much in the middle West toward improving the service and lowering the rates.

* * *

The Second Wheel Pit of the Niagara Falls Power Company.

Advices from Buffalo state that work is rapidly progressing on the second wheel pit of the Niagara Falls Power Company. The pit has a length of 463 feet 8 inches, a depth of 178½ feet, and it is 18½ feet wide. It is indeed a remarkable hole, comments a correspondent of a daily paper, and the sight it presents at the present time is interesting. The tunnel extension to the new wheel pit has been excavated, brick-lined from end to end, and connection between the brick lining and the tunnel and the pit has been made. Many of the castings for girders, streets, etc., have already been placed in the walls.

In the construction of this second pit the engineers are said to have met the same conditions of rock and water that were found in the construction of the first pit. From the top to the bottom the nature of the rock changes four times. The inflow of water through seams in the rock was practically the same as was met in the first pit. This water was caught in a "ring" sixty feet down and then pumped to the surface. This "ring" is practically a reservoir excavated in the sides of the pit. It is six feet deep and four and one-half feet high. Into it flows all the water that comes through the rocks above. When the pit is completed and the installation placed, the water that flows into the "ring" will be conducted to a point below the turbine deck, and there pass into the tunnel, and through it to the lower river. In the new pit, as well as in the old, care has been taken to see that the big hole is carefully drained. It may be recalled that the pit is to be lined with brick from top to bottom, and the rear course of brick will be hollow in order that inflowing water may be caught and conducted to the tunnel.

The tunnel extension made necessary by the construction of the new wheel pit has been driven. It is nearly 700 feet long, and runs in a curve from pit No. 1 to pit No. 2. It is of the same size and shape as the original tunnel. which is that of a horseshoe. It has been lined with brick, the first eight courses and the inverts being of vitrified brick, and the other portions of what is known on the work as "tunnel hards." Workmen are now connecting the tunnel lining with the wheel pit.

When the second section of the original pit was built two chambers were excavated in one of the sides. In these there are now installed huge water pumps and other machinery. The convenience of these chambers having thus been demonstrated, the Niagara Falls Power Company has had six similar chambers excavated in the west side of the new pit. Each of these chambers is 18 feet wide, 21 feet high and 50 feet deep. It is probable that oil and air pumps will be installed in them, and also the exciters for the mammoth dynamos that will be operated in the power house. The chambers are 138 feet below the surface.

Already a large portion of the steel skeleton of the new power station has been erected. While the original power house has commanded general attention for its beauty of architecture, this new station is likely to have more admirers. Its length will be 560 feet and its width 70 feet. The superstructure will be of Queenston limestone, a stone that is a soft gray in color. The roof will be broken by a gable at each end and one in the center, thus relieving the long stretch of roof and sides and adding materially to the beauty of the structure.

The capacity of the station will be 55,000 horse-power, made up of 11 units of 5,000 horse-power each. The turbines in the original pit are of the twin type, while those in the new pit will be single wheels of the Francis or inward discharge type working under a head of 145 feet. The turbines in the original pit work under a head of 136 feet.

One of the interesting new features in connection with this latest and greatest Niagara installation is the construction of a covered forebay on the west side of the power house. This forebay will have a length of 460 feet, and it will be 40 feet wide. Its outer wall runs along the inlet canal, and in order that the water of this canal may pass into the forebay 24 arches have been built, the top line of which is under water. Back about 10 feet from the arches are the racks, and against them the current of the water rushes straight from the openings of the arches, passing them into the huge penstock mouthpieces. The outer wall of the forebay is expected to keep back the floating ice in the inlet canal, while the fact that the forebay is covered, will be a protection to the men employed there, and also from the severe weather of winter time. With the exception of these arches, all the masonry on the big contract has been completed.

* * *

A Report on Wage Statistics.

One of the most satisfactory moves that has been made in connection with the census is the appointment by Director Merriam of Dr. Davis R. Dewey, Professor of Political Economy and Statistics in the Massachusetts Institute of Technology, to be an expert special agent of the census to prepare a report on wage statistics, to be used in connection with the census report on manufactures and the mechanical industries.

It is hoped that, as the result of the work now being organized by Prof. Dewey, the twelfth census will be able to show the actual wages paid in the great manufacturing industries of the country in a manner and with a degree of accuracy that has never before been attempted in census reports of this country.

All that it has ever been possible to obtain from any of our previous census reports, so far as wages are concerned, has been a very unsatisfactory, misleading, and uncertain "average earnings of employes," and this has been secured by dividing the total amount paid in wages by the total number of the employes reported. The quotient thus obtained has been accepted, but it has been in the absence of anything better, and it has always been with the knowledge that it has been a false quotient, for the reason that the divisor has not been the true number of employes to whom the total amount of wages have been paid.

It has not been reliable for purposes of comparison. for the further reasons that at different censuses different methods have been employed for ascertaining the average number, and different phraseology has been used in framing the several schedules of inquiry.

It has therefore been an agreed fact by the statisticians, who have been in the habit of using these figures, that these "average earnings" have been worthless so far as being any indication of the actual wage rates prevailing in the several industries. To obtain the real facts regarding wages for the censuses of 1890 and 1900, half a dozen picked men have been sent into the field by the Census Office, with instructions to copy the actual pay rolls of typical and representative establishments in different industries and in different sections of the country, and it is the analysis of these pay rolls, which will be made under Dr. Dewey's supervision, that will enable the Census Office to show the actual rates of wages, and determine what the actual trend of wages has been, as between 1890 and 1900, with a degree of precision and accuracy that has heretofore been impossible.

It is Director Merriam's determination to make the wage statistics of the twelfth census a reflection of the actual conditions prevailing in the various industries in 1900. Dr. Dewey was selected for this purpose for the reason that he has had such long experience in the practical handling of statistics, and also for the high reputation which he earned during the time that he was engaged as chairman of the Massachusetts Commission on the Unemployed several years ago.

A dispatch from Stockholm, Sweden, states that the Government has ordered the directors of the State railways to prepare plans for converting the steam railways to electric traction. Power will be provided by numerous waterfalls, the Supreme Court having decided that most of the river waterfalls belong to the crown, and not, as commonly believed, to the riparian owners.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

The Pan-American Exposition will close on Saturday.

◆

The Manhattan Elevated Railroad of this city will be running cars by electricity on its Second Avenue line about November 15.

◆

The New York Electrical Society will hold its 217th meeting this (Wednesday) evening at the College of the City of New York.

◆

The London "Daily News" declares that J. Pierpont Morgan is bearing the entire expense—$45,000—involved in installing an electric light system in St. Paul's Cathedral, London, and says it is a reproach to rich Englishmen that the benefaction should be left to an American.

◆

Contracts have been let for the equipment with electricity for headlights of all the passenger engines of the Chicago and Alton, Ill., Railway. The power will be derived from a small dynamo placed on top of the engine behind the smokestack. The new headlight, it is claimed, will throw a light clear enough to distinguish any object 2,000 feet ahead of the locomotive. The present oil lights do not reach further than 700 feet.

◆

A Boston paper says the Old Colony Street Railway Company, one of the sub-companies of the Massachusetts Electric Company, has been substituting aluminum for copper. President P. J. Sullivan says: "We made a thorough investigation of the use of aluminum by street railway companies as a substitute for copper in feed wires and, as a result, we installed about 10 miles of aluminum feed wire on the South Shore. Aluminum has given complete satisfaction, and our next order for feed wire will undoubtedly be for aluminum. The cost of aluminum is 20 to 25 per cent. less than copper and its value as scrap has the same proportionate value as copper. We found that aluminum was being used quite extensively by street railways throughout the country."

◆

The offer of Murry A. Verner, of Pittsburg, Pa., to buy all the municipal and private street railways of St. Petersburg, introduce electrical traction and organize a complete system of electric tramways, has been received very favorably by the local press, says a dispatch from St. Petersburg. The Municipal Council has been discussing the matter for several years, but Mr. Verner's offer is the first genuine step towards the introduction of electricity. The city owns three lines, and a number of other lines are owned and operated by two private companies. The city has begun legal proceedings against these companies with a view of unifying all the surface traction companies. Mr. Verner's offer stipulates that the city shall turn the private lines over to him when the matter has been settled.

◆

The Toronto Electric Street Railway carried, during the week when the Duke and Duchess of York were in Toronto, no less than 1,200,000 passengers, not counting transfers. During one day of that week 282,000 people were carried, and although the streets of the city were crowded with pedestrians and vehicles, not a single accident occurred. This would indicate that Toronto has an exceptionally good street railway service.

◆

Karpenesion, in Greece, is to be lighted by electricity, and United States Consul McGinley, at Athens, in a report to the State Department at Washington, says that it is desired to obtain the electric plant from the United States.

◆

For over a year now it has been stated that the New York Electric Vehicle Transportation Company would "shortly" place electric stages on Fifth avenue in this city. Not more than one or two stages have as yet materialized, but the announcement is again made that before December 1 eight electric "busses" will be plying up and down that avenue. Let us hope that there is some truth in the last announcement.

◆

A cable dispatch from Paris states that the question of submarine transit of the English Channel is occupying the minds of inventors. M. Goubet, inventor of a submarine boat, has made a perfect model of a passenger boat, 25 meters long, to run by electricity on a steel cable at a uniform depth of 15 meters. Passengers can be carried in salon compartments, with electric light, and every convenience. The passage would be as easy, says the dispatch, as a railway, with no vibration. Perfect safety is insured by an iron weight, which in case of need can be dropped, and the boat will rise to the surface. The estimated speed is 20 knots. Capital is the only thing required, says the inventor.

◆

From New Orleans, La., comes the report that the United Fruit Company has adopted the electric unloading system for unloading vessels and loading cars and will do away with Italian hand labor now used for this purpose. It is estimated that it will cut down the time of unloading one-third, the loss and damage to fruit one-fourth, and naturally reduces the expense. It will throw several thousand Italian fruit handlers out of work.

◆

Weather Observer B. Johnson, of Astoria, Ore., has received the plans and specifications from Major Langfitt, United States Engineers, in charge of that lighthouse district, for the wireless telegraph station to be erected at North Head, for reporting to the local weather bureau the arrival and departure of vessels at the mouth of the Columbia. The original plans for this station are made on estimates based on conditions which existed a couple of years ago, but it was found that the plant could not be constructed and placed in condition for use within the amount of the appropriation made by Congress for the purpose on account of the advance in the price of materials to be used. Since then the plans have been modified considerably in the hope that the work could be done for the original price fixed. It is difficult for the Government architects at Washington to accurately figure on the cost of construction under the conditions that exist there, but if the present plans prove to be too expensive the difficulty may be remedied by a further appropriation at the next session of Congress.

◆

A magnificent private car for use by members of the Everett-Moore Electric Railway Syndicate in traveling over their long trolley system is about to be built, the contract calling for its completion before February 1. The details were worked out by C. W. Mason, purchasing agent for the Cleveland (O.) Electric Railway Company, and the contract has been given to the J. C. Brill Company. The price is $15,000. The car is to be fitted up as a sleeper and dining car with every comfort for day traveling. There will be sofa beds, sleeping berths, plate glass flooring, sheet steel siding, pneumatic gongs, whistles, and sand boxes, a bathroom with a tile floor, tea and coffee urns, electric heaters for cooking food, folding wash stands, disappearing ice boxes and food refrigerators, disappearing tool boxes and controllers, patent electric headlights fitted with interchangeable glass for danger signals, electricity, gas, and hot and cold water.

◆

Preliminary trials recently carried out on the Valtellina-Colico-Sondrio electric railway in Italy, which is equipped with the Ganz system, are reported to have given every satisfaction, says the London "Electrical Engineer." The result of the tests, it is said, is to show that the installation is capable of driving a train of five cars at a speed of 44.7 miles an hour, and of maintaining this speed even on the up-grades, which are fairly steep. It was also proved that the generators supplied their 21,000 volts without trouble. The starting of the train is gradual on the descent of inclines of 14 per cent., and the decrease of the load on the central station is very apparent. The practice is to partly close the gates which admit the water to the turbines until the motors are taking their normal current again.

◆

American Institute of Electrical Engineers.

At the 157th meeting, held at 12 West 31st street, October 25, 175 members and guests being present, President Steinmetz gave an introduction to the general subject of the evening, which was "Regulation of Prime Movers and Successful Operation of Alternators." Papers were presented as follows: "Angular Variation in Steam Engines," by Mr. P. O. Keilholtz, of Baltimore. "Parallel Operation of Engine Driven Alternators," by Mr. W. L. R. Emmet, of Schenectady. "Parallel Running of Alternators," by Mr. Ernst J. Berg, of Schenectady. "Angular Velocity in Steam Engines, in Relation to Paralleling of Alternators," by Mr. Walter I. Slichter, of Schenectady.

The discussion was participated in by Messrs. R. H. Rice, J. A. Seymour, G. M. Peek, C. F. Scott, A. V. Garratt, R. T. Lozier, R. D. Mershon, C. P. Steinmetz and others.

At the meeting of the executive commitee in the afternoon twenty six new members were elected.

CYLINDERS FOR STEAM ENGINES.

BY W. H. WAKEMAN.

While the primary object of this article is to explain plans for determining the diameters of steam engine cylinders for various conditions, which is an interesting point for all progressive engineers, it does not comprise all of the features contained in this treatise, as many facts of interest to those who are engaged in steam engine work are so closely allied to the main subject that they almost form a part of it. The study of these plans with their accompanying data is sure to prove beneficial to the man who desires to be something more than a "starter and a stopper." When solving problems of this kind it becomes necessary to assume some of the factors to serve as a foundation for the others, but this assumption is based on conclusions which are admitted by a majority of engineers to be correct, although some of them relate to points that we cannot all agree upon.

For an illustration of this I will call attention to the fact that while many compound engines are built with low pressure cylinders that are twice the diameter of the high pressure, some engineers claim that if the proportions were in still greater contrast the results in practice would be as good or better than we now realize.

The first example presented is a simple, non-condensing engine to develop 250 hp. The boilers that are to supply steam are safe at 100 pounds pressure, and some engineers calculate on the full pressure at all times, which is never realized in every day practice, although it can be depended on for a portion of the time. In order to give a generous margin it is assumed that 90 pounds are available continuously at the boilers, and the initial pressure in the cylinder is 85 pounds making the absolute pressure 100 pounds, and the cut-off takes place at ¼ stroke, therefore the expansion rate is 4. The back pressure is taken at 2 pounds above the atmosphere, or 17 pounds absolute.

The clearance will not be considered in this article because it makes the computations much more complicated without being of corresponding importance. If the theoretical mean effective pressure of an engine is calculated with a cut off at ¼ stroke without considering the clearance, the actual pressure will be slightly higher owing to the effect of the clearance, therefore when it is ignored the results are on the safe side. The rule adopted for calculating the theoretical mean effective pressure is as follows:

Divide the stroke, expressed as unity or 1, by the cut off expressed in a fraction of the stroke and the quotient is the ratio of expansion. Find the hyperbolic logarithm of it and add 1. Multiply the sum by the initial pressure, and subtract the back pressure, both absolute. Applying this rule here results as follows: $1 \div \frac{1}{4} = 4$, the hyperbolic logarithm of which is 1.3863. Adding 1 and dividing by $4 = .5965$ and $.5965 \times 100 - 17 = 42$ pounds mean effective pressure.

The stroke of an engine for this purpose will be taken at 3½ feet and the speed at 90 revolutions, making the piston speed 630 feet per minute. The area of the piston may now be found by the following rule:

Multiply the horse power by 33,000 and divide by the mean effective pressure multiplied by the piston speed. In this case it is $\frac{250 \times 33.000}{42 \times 630}$ = 312 square inches.

From this the area may be found by dividing by .7854 and extracting the square root. It may also be found without calculation by referring to a table of areas of circles. 312 ÷ .7854 = 397, the square root of which is 19.9, showing that the diameter should be 20 inches, the area of which is 314 square inches.

The truth of the foregoing may be proved by calculating the power of this engine in the usual way, namely, by multiplying the area of piston, mean effective pressure and piston speed together and dividing the product by 33.000. 314 × 42 × 630 ÷ 33,000 = 254 horse power, which is as nearly as two calculations of this kind can be expected to agree, on account of omitting to carry out fractions to their limit.

If it is practical to install and use a condenser the diameter of cylinder should be less as follows: The cut-off should take place at 1-5 stroke, making the expansion rate 5, the hyperbolic logarithm of which is 1.6094, and applying the rule already explained, assuming the back pressure to be 3 pounds, shows that the mean effective pressure is 49 pounds. Proceeding to find the area as before results as follows. $\frac{250 \times 33{,}000}{49 \times 630}$ = 267 square inches, for which the corresponding diameter is 18.5 inches.

Proving this calculation demonstrates that 268 × 49 × 630 ÷ 33,000 = 250 hp. (The area of a circle 18.5 inches in diameter is 268 square inches.)

If a cylinder 20 × 42 inches is used for a condensing engine to develop 250 hp., the cut-off will take place at ⅙ stroke and the mean effective pressure will be reduced to 43 pounds. When sufficient load is added to this condensing engine to lengthen the cut of ¼ stroke as it was with the non-condensing engine, the mean effective pressure will be increased to 56 pounds and the engine will develop 335 hp., but if nothing is done to the non-condensing engine except to add a condenser, the cut-off will be shortened from ¼ to ⅙ stroke and the power developed will remain as before. The actual reduction in the volume of steam required is therefore 33 per cent., but all of this apparent saving will not be realized owing to a greater loss by cylinder condensation. A saving of 25 per cent. can safely be counted on.

Proceeding to determine the size of cylinders for a compound engine, we will assume that a cross compound, non-condensing engine is wanted, to develop 600 hp. with a boiler pressure that is limited to 150 pounds, taking the average carried at 140 pounds, and allowing a loss in the pipe of 5 pounds, making the initial pressure 135 pounds by the gauge or 150 pounds absolute.

If we expand this steam down to atmospheric pressure without making an allowance for loss, the combined expansion rate will be 10, as found by dividing the initial pressure by the terminal, both absolute.

Transferring steam from one cylinder to another results in a small loss which may be deducted from the expansion rate, or allowed for by taking the initial pressure for the second cylinder at a few pounds lower than the terminal in the preceding cylinder. The amount will depend upon the conditions under which the transfer is made. The difference is called the "drop" in pressure.

In order to divide the expansion equally between the high and low pressure cylinders it is necessary to extract the square root of the total rate, to determine the rate for each cylinder, because when each rate is given separately it is necessary to multiply one by the other to get the total. It is not proper to add them together as some have supposed. The square root of 10 is 3.16, but owing to the fact that the loss in pressure is greater in the cross compound than in the tandem compound, we may call this 3 without error.

The terminal pressure in a cylinder is found by dividing the initial pressure by the expansion rate. Then 150 ÷ 3 = 50 pounds and the back pressure is assumed to be equal to this.

We now have an initial pressure of 150 pounds, an expansion rate of 3 and a back pressure of 50 pounds. Applying the rule already explained shows that this gives 55 pounds mean effective pressure.

Assuming the stroke to be 3½ feet and the speed 90 revolutions makes the piston speed 630 feet per minute.

As the engine is to develop 600 hp., one half of it should be developed in the high pressure cylinder, or 300 hp. The required area of cylinder is $\frac{300 \times 33{,}000}{55 \times 630}$ = 285 square inches, the corresponding diameter of which is 19 inches, therefore the high pressure cylinder should be 19 x 42 inches.

With a "drop" of 5 pounds between the two cylinders, a back pressure of 50 pounds in the first, the initial pressure in the second or low pressure cylinder is 45 pounds, the expansion rate is 3 and the terminal pressure 15 pounds, or zero by the gauge, which is also the back pressure.

The mean effective pressure in this cylinder is 16 pounds. The area of it is $\frac{300 \times 33{,}000}{16 \times 630}$ = 917 square inches, the diameter of which is 34 inches, therefore this engine would be known as a 19 and 34 x 42 inch compound.

Suppose that we wish to design cylinders for a cross compound condensing engine to develop 800 hp., with a boiler pressure limited to 140 pounds, carrying an average of 130 pounds, 5 pounds of which are lost in the pipe. The initial pressure is then 125 pounds by the gauge, or 140 pounds absolute.

A total expansion rate of 12 will be right for this engine, the square root of which is 3.5 nearly, therefore the rate of expansion for each cylinder is 3.5. The terminal, also the back pressure, is 140 ÷ 3.5 = 40 pounds, and the mean effective pressure is 50 pounds in the high pressure cylinder.

A stroke of 42 inches will answer every purpose, also a speed of 90 revolutions or 630 feet per minute. As we wish to develop 400 hp. in each cylinder, the area of the high pressure must be $\frac{400 \times 33{,}000}{50 \times 630}$ = 419 square inches, the corresponding diameter of which is 23 inches nearly.

With a "drop" of 5 pounds between the two cylinders the initial pressure is 35 pounds in the second or low pressure cylinder, and with an expansion rate of 3.5 the terminal pressure is 10 which will give good results. With 3 pounds back pressure, the mean effective pressure is 19.5 pounds. The required area is $\frac{400 \times 33{,}000}{19.5 \times 630}$ = 1,074 square inches the corresponding diameter of which is 37 inches, therefore under the conditions that I have assumed in this case the engine would be 23 and 37 x 42 inches to develop 800 hp.

Treating the two parts of this machine as if they were separate engines, calculating the power of each by multiplying together the area of piston, mean effective pressure and piston speed, and dividing the product by 33,000 then adding the two together shows that the whole engine will develop 796 hp., or only 4 hp. less than before, which is a very small difference, and this is due to the dropping of fractions that it is not practical to carry out further.

These proportions are rather unusual, but will give good results under the conditions named. Assuming a boiler pressure of 125 pounds by the gauge, a combined expansion rate of 16, a "drop" of 5 pounds, a terminal pressure of 3 pounds, and the cylinders will be 24 and 46 x 42 inches to develop 800 hp.

Passing on to determining the diameter of cylinders for a triple expansion engine we will assume that it is to develop 900 hp., the boiler pressure is limited to 190 pounds, and after making the usual allowances the absolute pressure is 190 pounds. The combined expansion rate is 27, the cube root of which is 3, therefore the ratio of expansion for each cylinder is 3.

The terminal pressure in the first cylinder is 190 ÷ 3 = 63, and the mean effective pressure is 70 pounds. The stroke is assumed to be 5 feet, and the speed 80 revolutions, making the piston speed 800 feet per minute.

As 300 hp. must be developed in each cylinder, the required area of piston is $\frac{300 \times 33{,}000}{70 \times 800}$ = 178 square inches, the corresponding diameter of which is 15 inches.

If the "drop" between the first and second cylinders is 3 pounds, the initial pressure in the second is 60, the terminal 20, and the mean effective pressure 22 pounds.

The required area of second cylinder is $\frac{300 \times 33{,}000}{22 \times 800}$ = 562 square inches, and the diameter is 26.5 inches nearly.

With a "drop" of 3 pounds between the second and third cylinders, the initial pressure is 17, the terminal nearly 6 and the mean effective pressure 9 pounds.

Allowing a back pressure of 3 pounds the required area is $\frac{300 \times 33{,}000}{9 \times 800}$ = 1,375 square inches, which calls for a low pressure cylinder 42 inches in diameter, therefore this engine is 15 and 26.5 and 42 x 60 inches to develop 900 hp.

This example may be proved by assuming that all of the power is developed in the low pressure cylinder, thus regarding it as a simple condensing engine with a cylinder 42 x 60 inches, with a piston speed of 800 feet per minute.

The initial pressure is 190 pounds and the expansion rate is 27, the hyperbolic logarithm of which, plus 1 is 4.2958. Then 4.2958 ÷ 27 × 190 — 3 = 27 pounds mean effective pressure. The area of a 42 inch circle is is 1,385 square inches, but the actual area required is 1,375 square inches, making but a very slight difference. Using the actual area and calculating the power of this engine in the usual way shows that it will develop $\frac{1,375 \times 27 \times 800}{33,000}$ = 900 hp.

In some cases, especially where larger engines are to be designed, it may be desired to use two low pressure cylinders instead of one large one, making a four cylinder triple expansion engine. This may be done by taking one-half of the power that is to be developed in the last cylinder, and design one accordingly, using the same initial pressure, expansion rate and back pressure, as already explained, then providing another cylinder of the same proportions.

Or the area of the low pressure cylinder may be determined according to the foregoing rule, and divide it by 2. Divide this by .7854 and extract the square root of the quotient. This gives the diameter of one low pressure cylinder, and another must be provided of the same size. It is much more convenient, however, to use a table of the areas of circles as it saves time.

In this case the low pressure cylinder contains 1,375 square inches, one-half of which is 687½ square inches, which is equivalent to a circle 29.5 inches in diameter, therefore a four cylinder triple expansion engine to develop 900 hp. under stated conditions should be fitted with a high pressure cylinder 15 inches in diameter, an intermediate 26.5 inches and two low pressure cylinders 29.5 inches in diameter.

When designing the cylinders for a quadruple expansion condensing engine the same principles are employed as for a triple expansion engine. One quarter of the total power should be developed in each cylinder, and when the total expansion rate is decided the fourth root of it, or in other words, the square root of its square root is the expansion rate of each cylinder.

Suppose that the total expansion rate is 40 the square root of which is 6.3 and the square root of 6.3 is 2.5 therefore the expansion rate of each cylinder is 2.5.

In these, calculations are carried out far enough to answer all practical purposes, which is enough for the object sought.

In order to give good results the initial pressure should be 250 pounds. With 2.5 expansions in each cylinder and a "drop" of 3 pounds every time that steam is transferred from one to another, the terminal pressure will be about 5 pounds absolute.

When boilers that are calculated to produce superheated steam are more commonly used, the use of triple and quadruple expansion engines will be more general, as the greater complication which belongs to them as a necessary evil will be more fully warranted by the greater economy of fuel.

* * *

The Aurora Borealis Produced Artificially.

A foreign scientist has recently made some wonderful experiments in electricity. By plunging the negative wire of a powerful induction coil in a vessel of water and bringing the positive wire into contact with the surface of the water, or slightly below it, he has succeeded, so it is claimed, in creating the perfect aurora borealis, or northern lights.

CROSS-TALK IN TELEPHONE CABLES WITH WIRES LAID UP IN FOURS.*

BY JUL. H. WEST.

Calculating the electrostatic capacity in telephone cables, we find that we get lower capacity when the wires are laid up in fours than if they are laid up in separate pairs. In the former method the two wires lying diagonally opposite one another form the two conductors of each metallic circuit, and the calculation assumes that the planes of the two circuits will be normal to one another, so that the induction between both loops or circuits is balanced. It being of great importance, especially with long telephone cables, to lower as much as possible the electrostatic charge of the cable, the Post Office decided, in giving the order for the cable from London to Birmingham, that the wires should be laid up in fours; but when the greater portion had been put down, cross-talk was observed between the two loops of each four-strand. For this reason the rest of the line was made with wires laid up in pairs. In this article the reason why cross talk appears and some means of eliminating it are discussed.

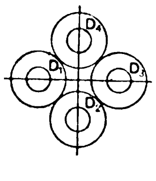

FIG. 1.

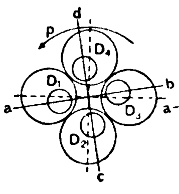

FIG. 2.

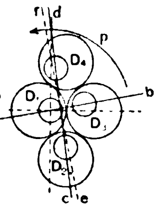

FIG. 3.

Fig. 1 represents a bundle of four wires insulated from one another by means of paper wound round each wire. As long as this bundle is not stranded, each wire will be concentric to the paper covering, as represented in Fig. 1, the wires resting on the edges of the loosely wound paper strips. But as soon as the bundle is stranded a pull occurs, which draws the wires (1) inwards towards the axis of the bundle, and (2) round the axis in the direction of stranding. As this pull only acts on the wires themselves, and not on the paper coverings, the wires are drawn out of their concentric position to the coverings, as shown in Fig. 2, in which figure, the arrow *p* indicates the direction of the stranding. The first effect of stranding the bundle is, therefore (as it is always the case with the wires laid up in pairs), to increase the capacity by bringing the wires closer together. The effect is greater the tighter the wires are stranded, and therefore it is good to take as long a lay as possible. But even now no cross-talk will occur, the planes *ab* and *cd* of the two loops being still at right angles to one another.

In practice, the cross-section of the strand will never be as illustrated in Fig. 2, for the reason that, in stranding the four wires together, the four drums which carry the four wires will never have the same friction, one rotating easier than the others. The result is that one drum will effect on its wire a greater pull than the other drums on their wires, and this difference in the pull must necessarily cause a change in the cross section of the bundle. This may be shown in the special case that one drum is rotating with very high friction whilst the other drums are rotating easily. In this case we get the section shown in Fig. 3, in which D_1 represents the wire on which a strong pull is exerted, so that the wire D_1 is pulled so tight that it forms the center of the strand, whilst the three other wires, D_2, D_3 and D_4, are wound spirally round D_1 lying at first on the right side of D_1, then passing above it to the left side and returning below it to the right side again. The paper covering of D_1 will be pressed out to the other side, so that D_1 lies eccentric in its insulation but symmetrically to the insulations of D_2, D_3 and D_4. The smaller pull exerted on the wires, D_2, D_3 and D_4, running spirally round D_1, forces these wires, as in the case of Fig. 2, not only centripedally towards the center of the strand—i. e., towards D_1, but also parallel to the direction of stranding, and in this way the section represented in Fig. 3 is obtained. From the sketch it is seen at once that the plane *ab* of the one loop is inclined to the plane *cd* of the other loop; to show this more clearly the dotted line *ef* represents the normal to *ab*.

A somewhat similar position of the wires will be obtained if the pull on the wires D_1, and D_3 is greater than on the two others, D_2 and D_4. Also in this case, as in any other case in which the pull on the four wires is not of the same amount, the two planes will be inclined to each other. Now, as a matter of fact, it will be impossible in practice to obtain the same tension on all four wires, and therefore it is impossible to obtain the section shown in Fig. 2; the planes of the two loops will always be inclined to one another, and hence the one loop will always disturb the other. It is probable that this is the reason why cross-talk is observed in cables with wires laid up in fours.

In the above remarks it has not been taken into consideration that the paper wrappings of the four wires pressing against each other lose their circular shape. It will be understood that this deformation of the paper wrapping will necessarily have the result of increasing this defect.

The question now is, how the cross-talk occurring in this way can be eliminated; it would be useful to have a means of doing this, as every possible way of lowering the electrostatic capacity of telephone cables for interurban lines will be of practical value. There seem to be various methods. At first it is obvious that, as the cross-talk has its origin in the stranding of the wires, the trouble can be lessened by stranding the wires as little as possible. This also has the effect that the wires lie further apart from one another, as it is the winding itself which pulls them together; therefore the electrostatic capacity will be lower the longer the lay is, and hence the lay should be made as long as possible with regard to the flexibility which the cable must have during manufacture and laying. Next, precautions should be taken to insure an easy rotation of the drums carrying the wires during the winding, and to secure as far as possible equal friction at all four drums.

In these ways the trouble cannot be entirely removed, but only lessened. The cross talk which will therefore occur in such cables must then be eliminated by means of balancing the cable when the different sections are joined together. For instance, if cross-talk occurs between two loops of a strand, then it will be easily understood that it would disappear if the strand were cut in two halves, and wires

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*Translated from the "Elektrotechnische Zeitschrift" for the "Electrician," London.

D_1 and D_3 changed—i. e., if D_1 of the one section were connected to the former wire D_3 of the second half, and vice-versa. Therefore, if cross-talk occurs in a cable, it will be possible to remove it by changing the position of the wires of one loop at proper places; or, instead of changing the two wires of one loop, changing all four wires, so that after cutting the cable, D_1 of one section is connected to the former wire D_2 of the following section, D_2 with D_3, and so on.

Another method would seem to be to change the direction of the winding at intervals, that to say, to make some lengths of cable with the wires wound in one direction (say clockwise), and other lengths of cable with wires wound in the opposite direction. If the wires of the first section are numbered A, B, C, D, and of the second *a*, *b*, *c*, *d*, then, if cross-talk occurs when A is connected to *a*, B to *b*, and so on, it must disappear when A is connected to *b*, B to *c*, and so on.

These methods, of course, are not applicable to subscribers' cables containing 400 to 500 wires; but for such cables of comparatively short length, the gain in relation to electrostatic capacity would not be of great practical importance. With interurban cables, on the other hand, which contain a much smaller number of wires—from 20 to 60—the work of balancing would pay. The work could easily be carried out in the following way: In laying the cable the different sections would at some places have to be connected together only provisionally, by means of small connecting boards; if then, in going on laying the cable, cross-talk occurs, the connections at the boards would have to be changed until the cross-talk disappeared. The extra work this would necessitate would be worth while, as with the wires laid up in fours the electrostatic capacity of the line would be considerably lower than if the wires were stranded in pairs.

ELECTRIC FULL-GAUGE RAILWAYS.*

The development of electric railways is a subject of interest to the public at large, especially at the present moment, when we are on the threshold of a new era in locomotive principles.

The engineering possibility of running full-gauge electric railways has already been proved; it is the economic aspect that has to be considered, then, most carefully. German railway engineers doubt the advisability of employing electric traction on long lines with an infrequent service, and in this they are probably justified on economic grounds, but the system of a frequent service of short trains has much to commend it, and this is the point on which the success of electric traction is hinged.

The maintenance of, and attendance to, the permanent way is the same whether ten or fifty trains run over it daily, while in the case of single wagons or short trains, with their light locomotives, bridge work can be made much lighter and cheaper. The latter point might prove an important factor in projected new lines, but falls out of proposals for the conversion of present lines to the electric system. The present arrangements for railway traveling are undoubtedly no longer abreast of the times. Long-distance passenger traffic ought to be separated from local passenger and goods traffic, while the necessity of connecting such cities as Berlin, Hamburg, Paris, etc., by a faster service is becoming more and more apparent. Further, the possibility of using short goods trains running at frequent and constant intervals would go far to relieve the congestion in the goods yard, would accelerate delivery and simplify the management. The employment of water-power for generating purposes has also great attractions in countries where it is available.

It was in view of these considerations that the Berlin Studien-Gesellschaft was formed, its objects being to determine the greatest speed attainable, the best method of generating power electrically, and transmitting it to the cars, and also details connected with the permanent way, width of rails, inclines, curves, etc. The Berlin-Zossen military line has been placed at the syndicate's disposal, and the experimental cars are rapidly nearing completion. Each car is built for 40 to 50 persons and is 67 feet long; it weighs about 90 tons, and is supported on two six-wheel bogies, each bogie being fitted with two three-phase motors, giving in all a capacity up to 3,000 hp. per car. The power is transmitted at 10,000 to 12,000 volts, three-phase, and transformed on the car, the motors being fed at a low pressure.

By this arrangement it is hoped to reach a speed of 124 miles per hour, and should the experimental line prove successful, a line will be built between Hamburg and Berlin.

In Italy the Lecco-Sondrio and Colico Chiavenna lines will be entirely propelled by electricity, the latter line, about 70 miles long, being capable of carrying goods trains of over 250 tons, On the Milan-Portoceresio line of 63 miles, electric traction will be employed for passenger traffic, at a speed of 54 miles per hour.

In France a commission has been appointed for investigating the problems connected with electric railway traction. It is hoped to make much use of water-power for generating purposes, the Riviera district especially offering natural facilities for this method of driving.

In Austria and Norway similar projects are being prepared.

A syndicate of Russian bankers propeses to connect St. Petersburg and Moscow with trains running at 93 miles per hour, at ten minutes' interval from each end, each train consisting of five 35-passenger cars.

Turning to the electrical part of the question, we have at least four systems to choose from in such schemes:

1. High tension three-phase generation, conversion in sub-stations and direct current supply, as on tramways. Example—Central London Railway.

2. High tension three-phase generation, conversion by static transformers in sub-stations, and supply to the lines at lower tension, the car line being driven by three-phase motors. Example—Burgdorf-Thun Railway.

3. High tension three-phase generation directly supplying the line, cars carrying static transformers, and three-phase motors for lower tension. Example--Berlin-Zossen experimental line.

The possibility of conveying high-tension power to the cars has been proved by Messrs. Siemens & Halske at Lichterfeld.

4. High tension three-phase generation directly supplying the lines, the cars being run by high-tension three-phase motors without the interposition of transformers.

Example—The Valtellina line, Budapest, on this system has been successful.

Considering these systems in order:

1. Has the advantage of direct-current motors for starting, but necessitates an expensive central station and sub-station upkeep and attendance, also a heavy line current for great power.

2. Motors are efficient, sub-station attendance small, but speed regulation more difficult. The last point is of less importance on long-distance railways. This system also necessitates a heavy line current for great power.

3 and 4. Are admirably adapted for long-distance railways. The line current is small for great power; the transformers in (3) provide the necessary weight for high speed, and hence are not really a disadvantage.

Turning to the present fastest services from steam traction, the "Railroad Gazette" quotes a run on the Savannah, Florida and West Railway of 150 miles in 130 minutes, or a speed of 69 miles per hour with a five-axle locomotive of 65 tons weight, and 6 feet 3 inch driving wheels.

In Europe the following runs are given as representative, the fastest being the one from St. Pierre to Orleans at 61.2 miles per hour:

Run.	Distance.	Time.	Speed.
St. Pierre-Orleans..	68.5 miles.	1 hr. 7 min.	61.2 m. p. h.
Dax-Bordeaux... ..	92 "	1 " 35 "	58 "
Amiens-Calais	104 "	1 " 49 "	57.2 "

In England (sic) the quickest run is the Forfar-Perth at 59 miles per hour.

Forfar-Perth......	32.8 miles.	0 hr. 33 min.	59 m. p. h.
Stirling-Perth... .	33 "	0 " 35 "	56.5 "

In Germany the speed is at present limited by law to 56 miles per hour. The fastest runs are:

Wittenberg-Hamburg at 51.3 miles per hour.
Stendat-Hanover at 49 " "

The practical limit of speed with steam locomotion has probably been reached at 75 miles per hour, and we must look to electric traction for further progress in this direction.

THE PUBLIC, THE OPERATOR AND THE COMPANY.*

BY CHARLES S. SERGEANT.

It would be difficult indeed to indicate the entire essence and range of street railway operation in fewer words than has been so tersely done by your President, in the title of this paper.

It is with diffidence that I shall try to present a few thoughts in its illustration, feeling it impossible within the necessary limitations to do justice to so comprehensive a theme. I assume that the intention of this title is to induce consideration, and perhaps discussion, of the relations of street railway companies to the public, and in particular those relations as concern with the question of private or municipal ownership, or in connection with the conditions affixed to grants or franchises, or possibly as to the relations of the street railway company to the public in the matter of taxation.

Urban and interurban transportation of passengers on the public streets and highways, is, in its nature, so different from the movement of passengers by waterways or upon private rights of way, that it is not only very difficult for those not actually engaged in the business to appreciate its duties and responsibilities and its limitations, but it is natural as well that there should be a sentiment in the public mind in relation to street railways, somewhat different from that felt towards steam railroads, for the reason that the business of the street railway is transacted in the streets.

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*Extracted from an article by Max Schiemann (Ueber Electrische Voll und Schnellbahnen) "Electrotechnische Zeitschrift," July 25, 1901 (Heft 30). From "Electrical Review," London.

*Paper read at the 20th Annual Convention of the American Street Railway Association, held in New York City, October 9-11, 1901.

Few, however, of those who are so ready to lay burdens upon the street railway realize or have ever learned that the streets are not the property of the municipality, but belong to the public. A citizen of any European country has the same right upon the streets of an American city that a resident in that city has. The care of the streets devolves, it is true, upon the municipality, but this of itself gives the municipality no right to sell privileges belonging to the public in connection with those streets. It is natural for citizens to assume that the street railway is a fair mark for the levying of taxes, ordinary and extraordinary, and the imposition of conditions, severe or otherwise, in granting franchises. From this sentiment, and other causes, results a great volume of special legislation, often ephemeral in its character, varying in different States, all calculated to impose burdens and regulations upon this business.

The great variety of such legislation is continually changing character, and minor legislation (if it may be so called) which originates in city councils, or with highway authorities, places the entire business of street transportation in conditions of uncertainty, to which few other investments, and none of like magnitude, are subjected.

In consequence of this condition of affairs, the street railway corporations are constantly placed upon the defensive, and necessarily much of the time and attention of their managements is devoted to a struggle for a reasonable existence.

In this connection I desire to quote from an address delivered at Philadelphia in April, 1900, at the fourth annual meeting of the American Academy of Political and Social Science, by Senator William Lindsay of Kentucky, this quotation showing that some of the evils of the present situation are appreciated by the public. The quotation is as follows:

"I may say, with reasonable confidence, that nine-tenths of the corporations now engaged in shaping public opinion would welcome the opportunity to abandon that policy and gladly confine their attention and devote their moneys to none other than the purposes of their creation. If they could be relieved from the annoyances and dangers attending the attacks of the place hunter and the professional agitator, and be protected against the demands of greedy and party bosses in charge of party organizations, they would submit without remonstrance to all proper restraints and forget their past political affiliations in the more energetic prosecution of their corporate business."

The proposition which I wish to advance in the desirability of legislation substantially uniform in its character throughout our several States of the Union, which shall fairly, definitely and with reasonable permanency, establish equitable relations between street railway companies and municipal and State governments. The most ardent advocate for heavy franchise taxes or governmental ownership could not but admit the desirability of such a solution of this question from every point of view. Surely there is no street railway company but would deem a permanent settlement of this character most advantageous. The banker would be spared the long and careful consideration of the particular and special conditions in some small city and State before making his loan, and the patrons of the street railway company would receive the benefit of that improvement in service, which would result from a fixed tenure and a lower rate of interest upon the money invested.

I can devote but little space to the question of municipal ownership. If the term "municipal ownership" includes municipal operation, which has usually been understood to be the case, I believe that the tendency of the experiments already made abroad, and the knowledge which will result from a fair minded study of the subject, will be towards the abandonment of any such proposition. Not the least important reason for such a belief is the fact that street railways in this country at least, have long since outgrown municipal boundaries in the sense of one company being confined to one municipality. Rapidly they are also outgrowing State boundaries. The natural tendencies of the business, therefore, are such as would greatly complicate the questions of ownership and operation by municipalities. Still further the rate of interest which has been earned upon the money invested by municipalities in Great Britain in street railways has been extremely small, and the facilities afforded have been most inferior to those enjoyed in this country.

In general, aside from the question of municipal ownership, Government restrictions upon the construction and the operation of tramways in Great Britian have been so severe that the citizens have been deprived practically, until the present time, of the benefits which have been enjoyed by the citizens in this country, growing out of the freer opportunities which have in the past been afforded investors to provide tramway facilities for cities and towns.

Unquestionably the most important social benefits, development of real estate, and increase of taxable property, have resulted from the general policy which has been in vogue in the United States. Why, then, should our legislatures and municipalities consider changes of a restrictive character, calculated to reduce the profits of tramway operation, and consequently restrain and dwarf its future development?

We are told by the so called "economists" that such is the trend of thought. Why should there be such a trend of thought, if a fair investigation is given the subject?

Presumably it will be generally admitted that the only proper source which can be drawn upon for payment of taxes, rentals, assessments for paving, street cleaning and other similar burdens, is the gross revenue, and consequently the net revenue of the street railway company, that this gross revenue is contributed by the public; that therefore all such burdens are taxes levied upon the public who use the cars. It must then follow that every burden of this character is one tending either to increase the fares, to maintain them at a high level, or to diminish the facilities afforded the public in the quality of cars and tracks, frequently of service and its general maintenance. A company unfortunately is regarded as an entity, rather than as an association of individuals. What ownership could be, in fact, more public than the ownership of a street railway corporation? Its shares can be purchased by everyone, and investigation will almost invariably show such ownership to be widely disseminated, and largely among a class of citizens, male or female, who can ill afford the impairment of the anticipated revenue.

What greater benefit could be conferred upon our citizens than legislation of a character calculated to eliminate from street railway securities their speculative nature, and place them substantially upon the basis of a savings bank deposit?

Many persons have pointed out the social benefits of street railways, especially electric street railways, and in particular due to the American system of a uniform fare, regardless of distance, within a reasonable radius from a center of population. Examination of this subject, especially in contrast to the European system, will show extraordinary advantages of the American system. The very small fare for the very short distances, which has been the custom abroad, has neutralized the benefit which otherwise would have been experienced by the community in such large cities as are provided with good tramway facilities. The poorest element in the population, as a result of such system, is confined abnormally in centers of population, and the amount of expenditure for policing, lighting and the attention to the public health, is necessarily greatly enhanced, and the moral effect of such concentration of population is most serious. Uniformity of fare tends to break up the slums; gives the workmen and his children a home of their own in the suburbs, and the question of rates is therefore one in which the great majority of the people are vitally interested.

In the light of these facts, is it not unwise to so tax in one form or another, the tramway enterprises, that they are prevented from rendering that service in transportation which might otherwise be secured? In these days of extravagant expenditures by municipality and State, it is doubtless a difficult matter to determine how the necessary funds are to be provided, and it is natural that the business of the street railway company, being always in the public eye, should seem a proper subject of assessment; but we should never lose sight of the fact that any such burden is in restraint of transportation facilities. A frequent argument for municipal ownership, is that municipalities can borrow money at lower rates of interest than private corporations. Why, then, pass such laws as will make the credit of private corporations good enough to command the lowest rates of interest? But, it is also argued that great profits would result, and therefore great abatement of taxes upon others, if the cities were in control of the tramway.

As I have already pointed out, it seems reasonable to suppose that the greatest benefits to a community have accrued, and will continue to accrue, by private ownership.

The question as to whether the capital invested in street railways and their property, should be exempted from all special taxation, in order that the greatest inducements may be afforded to investors to increase such facilities or that the profits should be restricted by limitation of dividends, or division of surplus earnings with the public, or bearing additional burdens in the maintenance of street surface and otherwise, is a fair ground for discussion.

Much may be said upon both sides of the argument, yet I am firmly of the belief that greater public benefit is to be had by exemption from taxation than by other methods.

It is not to be supposed that in any city or State capital should be permitted to conduct the affairs so vitally bound up with the private interests of every citizen without proper restriction and regulation, but the persons whose capital is invested have equal right to the protection of our laws, although that side of the question is too often overlooked. The best service can never be secured when several corporations are entrusted with the duty of providing transportation for any center of population. A properly regulated monopoly undoubtedly conduces to the best of service, and with suitable provision for freedom of investment in its securities, and suitable regulation of the service performed, the public good would be conserved, and the evils which arise from unnecessary investments, due to competitive enterprises, upon all of which (necessary or unnecessary) the public must pay interest, or must suffer as patrons and investors, would be avoided.

Under the conditions usually existing, the operator of a street railway is charged with duties and responsibilities of the most exacting nature. His work, in so far as it is manifest to the passenger, is of so public a character that there is little opportunity for a failure to provide proper service to go unremarked, and he is therefore held to so strict an accountability that the character of the service must necessarily be continually improved.

Probably the greatest misfortune attendant upon the conduct of a street railway is the inability to provide comfortable accommodations during the so called "rush hours" of the afternoon. It may almost be said that street railway traffic during rush hours increases as the square of the facilities provided. It is the constant endeavor of every operator to meet these conditions, but his efforts in the provision of extraordinary power supply, rolling stock and employes, are seldom appreciated, for the reason that it is impossible to prevent the overcrowding of cars during such hours. Overcrowding tends to much loss of revenue, to minor accidents to passengers, and creates in the minds of the passengers a feeling of disaffection towards the transportation company, and a belief in its extraordinary profits. As a matter of fact, everthing in these conditions tend to diminish the company's profits and to increase its investments.

Erroneous ideas prevail in the public mind relative to the profits derived from street railway enterprises. Those who are engaged in the business realize that the utmost endeavors and watchfulness are necessary to secure a fair return upon the investment. When there are added burdens in the way of excessive taxation, or otherwise, then indeed is the operator in need of all his experience and skill to save a proper dividend from the net earnings.

Your association has been in existence for a considerable term of years, but it has not become feeble in its old age. It would seem to be within the power of the association and within the scope of its duties to take some action looking towards uniformity of legislation relative to street railway companies, and to aid in the connection of facilities by dissemination of information upon many points as to which the general public is entirely ignorant.

If, in the few thoughts which have been suggested, there is anything worthy of your consideration, my purpose in writing this paper will have been accomplished.

LOAD FACTORS.*

BY W. H. BOOTH.

As the question of load factors has again come to the front, it may not be out of place further to discuss the matter. It is first necessary clearly to define what we severally may mean by the term load factor as applied to electrical power or light stations, for there are two load factors, namely, the station load factor and the running plant load factor. It is the former that is of chief importance. The latter does not merit so much consideration. The running plant load factor is simply the ratio of the units generated by the running plant in a given period to the units that would have been generated by the same plant if run steadily at its nominal rating. It is thus possible for the load factor to exceed 100 per cent., and, moreover, the ratio is dependent so much upon the nominal rating as to be quite useless as a guide, for there appears to be no standard system of rating plant. Assuming, for argument, that the term may be employed, however, it may be said that in a lighting plant the load factor of the running plant may be kept very close to 100 per cent., because, in a light station, the load is steady, but with a gradual increase and decrease over such long periods as to admit of fresh sets being started to meet the load, and of sets being stopped as the load falls off. In a power station this is not possible. The load varies all day long very rapidly between extreme limits, and the plant load factor cannot be high, but must, if a station be run properly, approximate to the station load factor or load factor proper. The use factor of plant is a term that may be discussed in this connection, as to which more anon.

The station load factor is different altogether from the plant load factor. It is the ratio of the mean station output in a given time to the maximum output. It is a most important factor to know, because on it depends the whole question of engine type, the economy of batteries, and so on. In one sense the station load factor is of small account in a lighting station. The mean load of a lighting station is made up of a steady long continued period of low output, and of a short period of maximum output; but this state of affairs is, as above stated, met by regulating the plant at work to suit the load, and a bad station load factor does not imply that the plant is being run uneconomically while it is being run, whereas in a power station a bad load factor does imply wasteful and uneconomical running. Here, again, comes in the use of factor of plant. In a power station the use factor will be high, because, except perhaps for a single spare set, all the plant is run all the time. In a lighting station the use factor is low, because the bulk of the plant is only run for quite a brief period. In this case a poor use of factor points to the economy to be derived from batteries. In the case of the power station, batteries are indicated by a low station load factor, and not by the use factor at all.

In power work the load variations are wide and rapid. Experience has shown me that this factor must be sought empirically. I have previously pointed out how it may be approximated to in ordinary English tramway stations with a closeness sufficient for purposes of power plant calculation. It is dependent, of course, on an enormous number of factors, but the cumulative average of all these factors is such a general mean, that it may be stated that load factor in a tramway station is practically a function of the number of loads. A car is a load. The load factor is dependent upon the number of such cars, because the cars, by their starting and stopping, each give an exceedingly bad load curve, and only by numerous superpositions of these bad load curves, one upon another, can a better average curve be secured. An infinity of cars would give a perfectly level curve, or a factor of 100 per cent., and in practice the load factor approaches to 100 per cent. a long way before the cars attain infinity in number.

Thus, with an average number of running cars of 64, the load factor will be about 45 per cent. Hence the importance of knowing what is the number of running cars. This can only be known when the total car-hours are known, when the average number of running cars can be found by dividing the car-hours by the station running hours. Here, again, the question of different conditions in different systems might be thought to act to vary results, but experience shows that if the number of running cars be found by this system, the load factor can be found from the number of cars within a fraction, that will be more accurate than any of the guess-work systems that appear to be at the foundation of most plant proportions. It is, indeed, easier to calculate load factors from the above data than it is to wring out the car-hours from the traffic man, who cares for none of these things. Given the number of cars always at work as an average, we should find approximately the following load factors to obtain:—

Cars ...	1	8	27	64	125
Factor ...	10%	22%	34%	45%	67%

With such figures to guide us we can do much, and their accuracy can be tested by any station man who will fish out his car hours and determine his "average running cars." The "average running cars," I admit, is an arbitrary figure, for in no systems do the running cars remain equal all day through. Still, the figure is good enough for calculation. Thus, for example, it is self-evident that in small systems running few cars the load factor is very poor, and when compound engines are used they must inevitably prove wasteful, because with them the ratio of expansion at small load is altogether extravagant, and there is no engine so wasteful as an underloaded engine. Load factors, therefore, in power stations exercise an enormous influence upon engine types, or should do so. Again, they ought to determine the question of accumulators, and the use or non-use of accumulators determines the type of engine. With an accumulator the engine may be reduced in size almost in the ratio of the load factor, while it may at the same time be raised in its character, for it will pay to run an economical type of engine on the steady load secured by means of accumulators.

The accumulator has an important influence upon the running plant load factor, which may be brought up to any desirable figure and maintained there. It also brings up the load factor of the station to nearly 100 per cent. This being so, it follows that where there are many cars and a high load factor, the good influence of batteries is less felt.

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*From the "Electrical Review," London.

It is then evident that station load factor, plant type, size and arrangement, are all closely interwoven, and that a new station cannot be economically designed unless the vital figures can be approximated to, and the first figure to be known is the average car number as regards use factors; far too little has been done to secure these. Few tramway managers have a knowledge of what proportion of their capital is lying idle. Yet the average use factor of cars is often as low as 50 per cent. In some cases it is only 35 per cent. The use factor of the track is never even dreamed of. Managers do not inquire how many car miles are run on each mile of track. They do not enter into the question of how they might make a greater use of their car bodies if they possessed bogie trucks in place of enlarged single truck horse cars. Yet all matters are purely those of factors.

Tramway statistics are, indeed, deplorably lacking. The neglect of them accounts for the very poor returns from electrical tramway undertakings, few of which do not start out handicapped by unnecessary power plant, and generally excessive capitalization in certain directions that might be avoided.

Were the influence of load factors on steam consumption better understood we should see less of specifications for tramway plant that call for steam consumption tests under full load conditions. Tramway sets ought to be tested on a load varying between selected limits. They should maintain speed at the maximum load, and their type should be left to the makers. We should then see what steam engine makers could do in real economy, as distinguished from the sham economy of full load testing.

Three-Phase Motors.

The satisfaction expressed at the working result of the direct-current system for the operation of electric tramways does not hold out any prospect of the introduction of the three-phase method for this purpose at an early date, says the "Mechanical World," London. According to Mr. M. B. Field, if three-phase motors are to be successfully employed for tramway work in crowded cities, the solution of the problem will be found in the combination of two shallow conduits of the slot-rail type with surface contacts. By this is implied the use of such shallow conduits as would avoid contact with underground gas and water mains, but sufficient to insure protection to a number of contact studs laid at intervals of from 2 to 3 feet in the floor of each conduit. The studs would be of the simplest character possible, involving no mechanism whatever with the exception of every fortieth, which would be of the automatic surface-contact type, and would control the succeeding 39 studs. It would not be a matter of necessity to place the automatic switches under the road bed, as they might be inclosed in boxes under the pavement, or several grouped together and erected in switch pillars and placed at intervals along the route where their accessibility would be a point in favor of the scheme.

It is stated that reliable estimates of financial returns of the Pan-American Exposition show a loss of over $4,000,000.

GREAT WIRELESS TELEGRAPHY TEST.

Ocean Steamers Exchange Messages While the Vessels Are 170 Miles Apart.

On the arrival of the Campania of the Cunard line in New York on Saturday two marvelous tests of the Marconi system of wireless telegraphy were disclosed. One was the dispatch of a message from a Campania passenger to Philadelphia by way of Ireland twenty-four hours ahead of the arrival of the Campania in New York. This was accomplished by sending the message to the Campania's sister ship Lucania, bound in an opposite direction, when the latter was 170 miles distant. The two vessels were full 1,100 miles off the Irish coast at the time. The Lucania having less distance to traverse, wafted the message to the wireless instrument at Crook Haven when she reached the radius of electrical communication, and it was then sent to Philadelphia by cable. The man who received it in Philadelphia had ample time to come to New York and meet his friend.

The second test was almost as wonderful. When the Lucania, bound east, was still 100 miles off the Irish coast a message was received on board from Crook Haven from a man in Paris who sent a welcome to one of the Lucania's voyagers and arranged for a meeting in London.

The Campania on emerging from Queenstown on October 20 plunged into a fresh westerly gale and a high head sea that sent waves slamming over her forward turtle back.

This weather continued almost throughout the voyage. It was still blowing fresh from the westward and a high sea was running on the night of October 23, three days out when the ether waves radiating from the pole of the Marconi instrument on the Campania picked up the current from the Lucania's instrument. This was at 12:20 P. M. and the Campania was about 1,100 miles out from Queenstown and at least 1,600 miles from Sandy Hook.

Complete communication was soon established and a comparison of bearings of the two ships by wireless telegraph showed that they were 170 miles apart. In less than 20 minutes the condition of those on board the Lucania from the time of leaving New York on October 19 was known on board the Campania. The Lucania was also informed of Campania's voyage up to the time of speaking her sister ship.

One of the last messages sent from the Campania was addressed to a gentleman in Philadelphia, an acquaintance of one of the Campania's voyagers, informing the Philadelphia man of his friend's presence on the Campania.

This message the Lucania sent to the wireless instrument at Crook Haven when the Cunarder was still off the Irish coast. It was then cabled to Philadelphia. Hardly had it been sent when the Lucania's receiver began to click. The operator wrote down a message from a man in Paris, who was anxious to meet one of the Lucania's voyagers.

The telegraph communication between the Lucania and Campania at sea was kept up without interruption from 10:20 P.M., when the current was established, until 6:25 A.M. of the 24th, an interval of more than eight hours.

All this time the wind and sea were both too high to make deck promenading pleasant for the passengers. Every officer on the Campania, from Captain Walker down, was elated at the great success of the wireless system. They regarded it as a conclusive proof of the value of this means of communication at sea.

Inspecting the New Wireless System.

London, Oct. 26.—The naval attachés of the United States, German, and Austrian Embassies in London to-day officially inspected the Orling-Armstrong system of wireless telegraphy and telephony, in which earth currents are used. Commander Clover, representing the United States, operated the transmitter. Messages in Morse characters were satisfactorily sent a distance of three quarters of a mile.

A short iron rod was stuck in the ground at the sending and receiving stations, and the instruments were connected with these rods. The inventors claim to have operated in a similar manner over a distance of twenty miles.

In the next experiment the instruments were connected with a semaphore apparatus, the arms of which were thrown up and down at a distance of three-quarters of a mile. An attempt to control the steering apparatus of a torpedo at the same distance was more or less successful, but the trial of telephonic communication failed.

The Revised Tariff for the Philippines

The revised tariff for the Philippine Islands will become operative on November 15, 1901, and among its provisions will be found the following:

Amperemeters, $25 per 100 kilos, net weight.

Automobiles for passengers, $60 each.

Automobiles for merchandise, $60 each.

Batteries, wet and dry and parts for same, $3 per 100 kilos, net weight.

Batteries, storage, $25 per 100 kilos, net weight.

Cables, for conducting electricity over public thoroughfares, $5 per 100 kilos, net weight.

Cables, submarine, telegraphic, free.

Calcium carbide, 2 cents per kilo, net weight.

Carbon, prepared for electric lighting, $5 per 100 kilos, gross weight.

Copper wire covered with textiles or insulating materials, $5 per 100 kilos, net weight.

Dynamos, $5 per 100 kilos, net weight.

Electric fans, $3 per 100 kilos, net weight.

Galvanometers, $25 per 100 kilos, net weight.

Generators, electric, $5 per 100 kilos, net weight.

Graphite, unwrought, 20 cents per 100 kilos, gross weight.

Incandescent lamps, mounted or not, $2 per hundred,

Insulators, of common glass, 80 cents per 100 kilos, gross weight.

Insulators, of porcelain, plain, $4 per 100 kilos, gross weight.

Motors, electric, $5 per 100 kilos, net weight.

Stoves, electric, $3 per 100 kilos, net weight.

Voltmeters, $25 per 100 kilos, net weight.

Merchandise in transit at the time this revised tariff goes into effect may be entered under the provisions of the law existing at the time of shipment, but it is provided that this privilege shall not be extended beyond 60 days after the enforcement of the revised tariff.

Net weight includes immediate interior packings.

Gross weight includes that of all coverings.

The metric system of weights and measures will be used.

Duties are assessed on goods imported from the United States just the same as though they were imported from some foreign country.

CANADIAN NOTES.

(From our Ottawa Correspondent.)

The electrical equipment of McGill University, Montreal, has been increased by the addition of a 300-kilowatt power storage battery, which will be used for lighting and experimental purposes, when it is not desired to use the steam power plant. In addition to what has been purchased, the electrical department has received many machines of interest and value from the Westinghouse and other companies. Among them are a number of standard electric measuring instruments—standard voltage meters, ammeters and wattmeters. A standard subdivided megohm, having a current carrying a capacity of about half an ampere, perhaps one of the finest pieces of apparatus of its kind in existence, is the gift of a New York gentleman, a friend of the university.

The Dominion Government telegraph service, from Ashcroft, B. C., to Dawson, in the Yukon district, is proving a difficult one to keep open. Advices just received at the Public Works Department state that the line is down somewhere north of Quesnel and business will be tied up until the break is located. This makes the second break in three weeks, so that it looks as if the winter service will be rather irregular. Between now and the month of January, when traveling will not be safe on the ice, the telegraph is about the only means of communication between Dawson and the outside world.

Over 125 men are now employed on the site of the Consumers' Electric Company's new power house at the Chaudiere Falls in Ottawa. On a rough estimate, over 3,000 square yards of rock have been excavated, and fully 4,000 yards more will be taken out of the solid rock. From present indications, the building will be completed and plant installed, ready for the development of electric power, in about nine months.

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Important Patent Infringement Decision.

An important decision was handed down in the United States District Court for the Western District of New York by Judge Hazel October 22 at Buffalo. The Electric Smelting & Aluminum Company of Cleveland, O., began equity proceedings against the Pittsburg Reduction Company of Niagara Falls, N. Y., for infringement of a patented process for cheaply separating aluminum by an electrical process. Judge Hazel held that the defendant company did not infringe the patents of the plaintiff. This, in effect, means that the Pittsburg Reduction Company will be allowed to continue the manufacture of aluminum. As the company can market the article, by virtue of its improved processes, much cheaper than any other company, it has a monopoly upon the production of aluminum.

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New York Electrical Society.

The 217th meeting of this Society will be held at the College of the City of New York, corner of Lexington avenue and 23d street, this (Wednesday) evening, October 30, at 8 o'clock. Mr. F. W. Willcox, of the Edison Lamp Works of the General Electric Company, Harrison, N. J., will deliver a lecture on "The Manufacture and Use of the Modern Incandescent Lamp." Mr. Willcox's lecture will be a review of one of the largest branches of the electrical industry and will take up the subject of lamp manufacture, exemplifying the progressive changes which have been made in perfecting the lamp and in lowering its cost to the public. The various steps in the production of the lamp will be elaborately illustrated with slides. Mr. Willcox will also treat upon the uses of the lamp and discuss the part which it plays in the illumination of the present day, as well as various economic features of efficiency, life, etc.

As an appropriate supplement to this lecture, Mr. Luther Stieringer, consulting electrical engineer of the Pan-American Exposition, has kindly consented to deliver a brief address on "The Incandescent Lamp at the Pan-American Exposition." The magnificence and beauty of the night spectacle at the Exposition has excited the admiration of the world. Mr. Stieringer will describe how these effects were obtained simply with the aid of the incandescent lamp and will outline the principles to be observed in the employment of light for artistic effects.

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PERSONAL MENTION.

Mr. Philip Gossler of Columbia, Pa., has been elected general manager of the Royal Electric Company of Montreal, Canada.

Mr. John McNamara, second vice president of the United Traction System of Albany, N. Y., has been elected president in place of Mr. R. C. Pruyn.

Mr. Charles F. Mack has resigned as secretary of the Warren Electric Company of Sandusky, O., to accept a position with the Kilby Manufacturing Company of Cleveland.

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COMMERCIAL PARAGRAPH.

The Smith & Hemenway Company, of 296 Broadway, New York, importers and manufacturers of a line of Swedish plyers, are putting on the market what they call their Swedish Sure Grip Climber. The spur, in addition to being welded to the upright, is also riveted, thereby insuring a solid connection. We are informed that in a number of tests recently made they have demonstrated beyond a question of doubt that the spur is there to stay and it is practically impossible to knock it out. They have been experimenting quite some time in the manufacture of climbers, and have now struck a standard and will hereafter warrant each and every climber, and should the spur loosen or come out they will either refund the money to the purchaser or replace the climber by a new pair. It would be well for anyone interested to write for a copy of the "Green Book of Hardware Specialties," published by the above firm, which gives full information with reference to their goods and which will be sent free on application.

SWEDISH SURE GRIP CLIMBER.

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INCORPORATIONS.

The Pittsburg Electric Machine Company, Pittsburg, Pa. Capital stock, $1,050.

The Storey Motor & Electric Company, New York City. Capital stock, $500,000. Incorporators: S. Livingston, Frederick Weiner and Rupert A. Jenks.

The Rapid Traction Construction Company, Custer, S. D. Capital stock, $5,000,000. Incorporators: E. W. Farnham, B. R. Noble, George J. Hicks, I. N. Woodbury and Charles E. Nasen.

The El Paso Electric Company, Trenton, N. J. Capital stock, $1,250,000. Incorporators: Henry B. Sawyer, John W. Hallowell, J. Harold Oakes, Benjamin H. Dibblee, Owen W. Young and James B. Dill.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCT. 22, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

684,791. Electric Resistance. Eugene R. Carichoff, East Orange, N. J., assignor to the Sprague Electric Company, New York City. Filed Aug. 1, 1901.

684,865. Mechanism for Making Trolley-Tracks. Fred J. Richard, Bloomsburg, Pa., assignor to Henry B. Newhall, Plainfield, N. J. Filed Sept. 18, 1900.

684,881. Railway-Signal. Herbert B. Taylor, Newark, N. J. Filed Aug. 7, 1900.

684,952. Street-Railway Signaling System. John J. Ruddick and Charles E. Rand, Newton, Mass., assignors, by direct and mesne assignments, to the United States Electric Signal Company, Portland, Me., and Newton Highlands, Mass. Filed Feb. 27, 1899.

684,964. Car Fender. George W. Webb, St. Louis, Mo. Filed July 12, 1901.

685,109. Car-Fender. Joseph P. Cornelius, St. Louis, Mo. Filed Aug. 15, 1901.

685,118. Trolley. Albert J. Eberwine, Slatington, Pa. Filed Aug. 8, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

681,785. Electric-Arc Lamp. Jean Bouillet, Levallois-Perret, France. Filed Dec. 20, 1899. Renewed March 16, 1901.

684,880. Incandescent-Lamp Base. Alfred Swan, New York City, assignor to the General Electric Company of New York. Filed March 6, 1890.

ELECTRICAL MACHINERY AND APPARATUS.

684,883. Power-Transmitting Device for Engines. Elihu Thomson, Swampscott, Mass. Filed Nov. 16, 1900.

685,145. Transmission or Coupling Device for Power Engines or Machines. Hugo John, Erfurt, Germany. Filed Sept. 8, 1900.

TELEPHONES AND TELEPHONE APPARATUS.

684,963. Telephone Instrument. Willis W. Washburn, Chicago, Ill. Filed Nov. 5, 1900.

685,084. Party Line Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard & Supply Company, Chicago, Ill. Filed April 28, 1899.

685,229. Apparatus for Recording and Repeating Telephonic Speech. Harry A. Rhodes, Denver, Col. Filed Jan. 2, 1900.

MISCELLANEOUS.

684,831. Process of Preparing Secondary-Battery Plates. Arthur Lehmann, Berlin, Germany. Filed Oct. 10, 1900.

684,893. Electric Feed Regulater for Steam-Boilers. Marcy L. Whitfield, Memphis, Tenn., assignor to the Reliable Automatic Boiler Feed Company, New York City. Filed April 13, 1901.

684,906. Electrical Reciprocating Apparatus. John Brown, Belfast, Ireland. Filed July 10, 1900.

684,930. Mechanism for Motor Vehicles. Darwin Hanauer, Long Island City, and Thomas Veitch, Yonkers, N. Y., assignors to the Daimler Manufacturing Company, Long Island City, N. Y. Filed Dec. 13, 1900.

684,950. Electric Mine-Locomotive. Cyrus Robinson, Columbus, O., assignor to Joseph A. Jeffrey, same place. Filed Sept. 14, 1895.

684,977. Electric Belt. Andrew Chrystal, Marshall, Mich. Filed Aug. 19, 1901.

685,008. Electric Signaling System. John J. Ruddick, Newton, Mass., assignor to the United States Electric Signal Company, Portland, Me., and Newton Highlands, Mass. Filed June 20, 1899.

685,012. Means for Increasing the Intensity of Electrical Oscillations. Nikola Tesla, New York City. Filed March 21, 1900. Renewed July 3, 1901.

685,042. Electric Furnace. William T. Gibbs, Buckingham, Canada. Filed Oct. 14, 1897.

685,043. Electric Method of Fusion. William T. Gibbs, Buckingham, Canada. Original application filed Oct. 14, 1897. Divided and this application filed March 15, 1901.

685,072. Arrangement for Controlling Electric Elevators. Emil A. Wahlstrom, Cannstadt, Germany. Filed Aug. 25, 1899.

685,101. Electric Battery. Paul Chapuy, Vincennes, France. Filed Feb. 21, 1901.

685,110. Electrically Illuminated Display-Fountain. Franklin B. Crouch, New York City. Filed June 13, 1901.

THE TELEPHONE WORLD.

To Battle Against the Bell Company.

All of the indications point to a battle royal between the two big telephone corporations in Chester and Delaware County, Pa. For months the United Telephone Company has been at work consolidating the local and independent companies until a chain has been established in that State from Chester to Pittsburg, and from thence to Chicago. This will insure long distance service, and it is said that as soon as the circuits are completed that a war of rates will ensue between the Bell and the United.

The Delaware County Company, which operates a large circuit in Chester, has gone into the United Company, and is one of the most important branches of the system, as it has a large number of subscribers and the list is continually increasing. It has a system at Media, and is gradually extending its lines to the county towns and to this end franchises have been granted by the various borough councils. The entire summer was occupied in this work, in fact, and in a short time the company will be ready to connect with the long-distance wires to Pittsburg from Delaware County by way of the Darby office.

The United Company by its alliances with other companies is extending its service in the city of Philadelphia, so that in the very near future the company that practically began with the Delaware County Telephone Company in Chester will be a most formidable rival to the Bell Telephone Company.

The Bell people, or the Delaware & Atlantic Telephone Company, as it is known locally, has not been idle by any means. It has displayed greater activity than at any time in its history and has made great improvements and additions to its system, not only in Chester and county, but in parts of the State and country, so that it is giving a wider range of connections than at any time since the invention of the telephone.

The People's Telephone Company of New Orleans, La., through Manager D. R. Sharpe, has announced that it will install in that city a two-cent message system. Manager Sharpe said that the scheme would be started within a very short time. The telephones will be put into any residence or business house, and provided with a slot into which the two cents' charge for a message can be dropped. The scheme has been decided upon with a view of increasing the patronage. The company is said to have 1,100 machines in operation throughout the city now, and hopes by the copper cent plan to increase the number to double that amount.

The Wisconsin Telephone Company reports a net gain of 309 subscribers in September, and a net gain of 2,036 subscribers since January 1, making a total number of 22,814 subscribers on September 30. The Erie Telephone System, of which this company is a part, reports a net gain of 2,795 subscribers in September, and a net gain of 18,599 since January 1, making a total number of 159,969 subscribers on September 30.

Within the past few days the local management in Scottsboro, Ky., of the Cumberland Telephone system has advanced the rent on the lines in business houses from $1.25 to $1.50 per month. Some of the subscribers have refused to pay the raise, and are having their 'phones taken out. It is thought that others will do likewise.

An independent telephone company was lately organized at Aurora, Neb., which will be known as the Hamilton County Farmers' Telephone Association. Exchanges will be put in at Aurora and Bromfield, and the entire county will be wired and 'phones placed in many of the farm houses.

At a recent meeting of the Tulare, Cal., city trustees, a franchise was granted to the Tulare County Telephone Company to enter that town with its system. It is now scattered through the Enterprise and Laurel districts and has given great satisfaction.

L. Tradell and Charles Suiter of New Orleans, La., electricians for the Cumberland Telephone Company, have recently been in Jennings of that State, to install an exchange. The new switchboard is the latest improved, and when the exchange is opened it will be up-to date.

A force of men is now at work putting in the telephone line between Gann Valley and Kimball, S. D., and it is expected to have the line in operation by the first of November. This will be the first telephone line constructed in Buffalo County.

The Cumberland Telephone Exchange Building in Meridian, Miss., was recently gutted by fire and nothing saved but two switchboards and the routeboard. The insurance was $2,000.

New Telephone Plant.

It is expected that by the first of next month a beginning will be made in the operation of a manufacturing plant in Washington, D. C., that will give employment to some 600 men. As preliminary to this a real estate transaction has practically been closed, which involves the expenditure for property of something over $200,000.

The property that has been selected is the large tract of land belonging to the Metropolitan Railroad Company at the western end of the P street bridge over Rock Creek. A deposit has been made for the purchase of this land at the figures above named by the Telephone Company of America. It is the intention of the company, according to the statement made by Col. T. W. Tyrer, the secretary, to begin there the making of the instruments in use by the company in the various places throughout the country where exchanges are now being operated. At present the corporation has its instruments made by a concern that has a plant at Relay, Md.

In establishing its own manufactory in Washington the company is continuing the same policy it had in view in locating its principal offices there. It is not proposed to make any change in the executive offices, which will continue to be in the Builders' Exchange Building on 13th street, between G and H streets.

Independent Telephone Association of Maine.

The Eastern Telephone Company tendered a banquet a short time ago to managers and directors of minor companies controlling local lines in Western Maine. About 60 persons were present. An association was formed, to be known as the Independent Telephone Association of Maine, with these officers: President, M. S. Bird of Rockland, also president of the Eastern; vice-presidents, G. W. O. Perham, Bryant's Pond; John W. True, New Gloucester; L. A. Goudy, Portland; secretary and treasurer, S. T. White, West Paris, executive committee, one director of each line.

William T. Cobb, of Rockland, and J. M. Libby, of Mechanic Falls, were among the leading speakers.

The Winona, Minn., Telephone Company, which will cooperate with the new independent telephone line being built from Minneapolis to La Crosse, has purchased the Phoenix Company of Rushford, which brings the following towns into communication with Minneapolis: Rushford, Lanesboro, Preston, Wykoff, Fountain, Spring Valley, Isinour's, Canton, Harmony, Peterson, Whalen, Caledonia, Spring Grove, Houston, Money Creek, Hokah, La Crescent, Bratsburg and Black Hammer.

The Home Telephone Company, which has been engaged putting in a system in Dunkirk, N. Y., is about ready to begin operations. Five modern Eureka system switchboards with accommodations for 500 subscribers have been installed in the exchange. There are 100 numbers to each board and one operator has charge of each switchboard. The new company will begin operations with about 80 subscribers and this number will be increased rapidly, as each subscriber has the advantage of a private wire.

The Belmont Telephone Company of the Ohio side, which is connected with the National of Wheeling, W. Va., is rapidly fulfilling its promises, and in the near future will cover every available point in Eastern Ohio. The company now has almost all Belmont and Harrison County towns and villages connected with its lines, at a rate that is perfectly satisfactory to its patrons.

The poles for the telephone line between Newbern and Morehead City, N. C., are all in place. The placing of the wires will begin at once from the lower end of the line, and will be pushed to completion. The line will prove a valuable factor in the business of that section and will bring into direct communication the various points along the line.

A new switchboard was recently put in for the local telephone system at Kinston, N. C. Howard F. Jones, the general superintendent of the Carolina Telephone Company, is having improvements made over the whole local system with the purpose of giving Kinston a good telephone service.

Control of the recently organized $10,000,000 Cumberland Valley Telephone Company of Pennsylvania is stated to have been obtained by the Telephone, Telegraph & Cable Company of America.

The Cumberland Telegraph & Telephone Company is having poles placed between Saltillo and Swallow Bluff, Tenn., and will at once extend its line to that point. This town has never before had any telephone service.

Independent Telephone Company Wins.

A dispatch received last week in Wall Street, this city, says that Dudley E. Waters, president of the Grand Rapids National Bank, is at the head of a syndicate of Michigan capitalists who have secured a 30 day option from the executive committee of the Erie Telephone & Telegraph Company to purchase all its holdings in the Michigan Telephone Company—30,000 shares, a controlling interest.

This means a triumph of the independent telephone men in Michigan. It will result in a consolidation of the Michigan Company and the new People's Telephone in Detroit.

President Waters confirms the news in a personal dispatch.

Telephone Line in Alaska.

According to Nome newspapers a telephone service between Nome and Teller and Council City will soon be in operation. All material for the Council City line via Salmon River is on the ground and the material for the Teller end of the line was barely expected from the South on the late steamers.

Oshkosh, Wis., will probably again witness an active telephone rate war early next year. The rate price war inaugurated there a year or two ago was the result of fierce competition between the Northwestern Telephone Company and the Wisconsin Company. Following the elimination of the Northwestern Company from the field, the prices to telephone users stiffened. A new company with $1,000,000 capital stock will have a toll line system, extending from Fond du Lac to Steven's Point, and complete city systems in Oshkosh, Fond du Lac, Appleton and Green Bay.

The Roebling Construction Company, F. S. Katzenbach & Co., Joseph D. Smith, J. B. Margerum, J. W. Covert, all of Trenton, N. J., and A. C. Welchain, of Lancaster, Pa., have been awarded contracts for work on the proposed new building of the Interstate Telephone Company in Trenton, N. J., and the only contract yet to be awarded is that for carpentry. The building with its equipments will cost in the neighborhood of $50,000.

Manager G. W. Griffen, of the Sheridan, Wyo., Telephone Company, recently stated that work on the extension of the telephone line to Banner, would shortly be begun. This will give a telephone service to a large number of people and will add 50 or 75 instruments to the present system.

The city council of Bedford, Ind., granted a franchise to James Ruddick for the establishment of a telephone exchange at that place. The line is 70 miles in length and connects Bedford with a large number of important country towns. The wires are run up to the city limits.

The Washington, Ind., city council, has granted the Independent Telephone Company a franchise. The new company agrees not to charge for service until it has 300 subscribers, which is more than the Bell Company now has there.

The Marianna, Fla., Telephone Company, with $5,000 capital, has been incorporated to establish and operate a telephone exchange in that place; also to erect through to the counties of Jackson, Washington and Calhoun.

The Macon, Mo., Telephone Company recently completed an independent line from Macon to Ardmore. It is also running a new line to College Mound.

Extensive improvements are to be made in the Interstate Telephone Exchange in Raleigh, N. C. In fact an entirely new equipment is to supplant the present office outfit.

TELEPHONE INCORPORATIONS.

The Orion Telephone Company, Orion, Mich. Capital stock, $1,000.

The American Telephone Directory Company, Detroit, Mich. Capital stock, $5,000.

The Wyoming and Cattaraugus Telephone Company of Arcade, N. Y. Capital stock, $10,000. Directors: Theodore Hayden, P. E. Merrill and B. B. Lewis, Sandusky.

The Citizens' Telephone Company of North Missouri, Monticello, Mo. Capital stock, $1,200. Incorporators: Cyrus C. Raine, Pike Hanna, Charles Little and others.

The Rapid Service Telephone & Telegraph Company, Minneapolis, Minn.—to operate, construct and control telephone and telegraph lines in Minnesota. Capital stock, $100,000. Incorporators: Eder H. Moulton, Robert H. Newlon, John A. Modisette, Franklin Benner and Claude B. Leonard, all of Minneapolis.

GENERAL ELECTRICAL NEWS.

Lighting.

Andrews, N. C.—F. P. Cover & Son contemplate installing an electric light plant, and extending wires to Murphy, a distance of 16 miles.

Batesburg, S. C —This city has taken a new charter, as recently reported, for the purpose of general improvements, which include an electric light plant, construction of waterworks and street improvements. M. B. Edwards, city treasurer, can be addressed for further information in relation to same.

Boonville, N. Y.—The proposition for bonding the corporation for the sum of $45,000 for the purpose of erecting an electric light plant, to be owned and operated by the village, was voted on a short time ago, and carried by a large majority.

Burlington Junction, Mo.—An electric light plant will be built at this place.

Cabery, Ill.—Business men of this place want an electric light plant.

Centralia, Wash.—The council has let the contract to N. Meisenzahl for building a new power house for the city electric light plant; it will be located outside the city limits.

Denver, Col.—A scheme is on foot for the purpose of organizing a company that will have for its ends the lighting by electricity of all the towns in the Clear Lake Valley and immediate vicinity.

Granite, Ore.—It is announced that this place will have an electric light plant.

Houston, Tex.—The Citizens' Electric Light Company, of which W. W. Chapman is general manager, will expend $150,000 in enlargements and improvements to its plant.

Howell, Mich.—This city will start her municipal commercial lighting plant with 2,000 incandescent lights.

Kirkwood, Ill.—This place will have electric lighting. The franchise has been let to outside parties.

Marianna, Fla.—This city contemplates establishing a system of electric lights. Information in relation to same may be obtained from the mayor.

Martinsville, Va.—A proposition has been made for the organization of a company to establish a system of electric lights. The mayor can be addressed.

Mexico, Mo.—A proposition is to be submitted to the voters to bond this city in the sum of $35,000 for the purpose of acquiring an electric light plant.

Minneapolis, Kan.—At a special meeting of the city council a ten-years' franchise for an electric light plant was granted to R. C. Jackman & Co.

Newbern, N. C.—The citizens will vote on December 3 on the issuance of $15,000 of bonds for an electric light plant. Address the mayor for further information in relation to same.

Rockwood, Tenn.—The board of mayor and aldermen has called an election, to be held November 17, for the purpose of voting on a proposition to issue $6,000 bonds to complete the electric light system.

Stanton, Neb.—An electric light company has been organized here, and this place will soon be lit by electricity.

Scotland, S. D.—A. E. Parmenter of this place has been granted a 20-year franchise by the council for an electric plant.

Southampton, N. Y.—The Southampton Electric Light Company held a meeting of its stockholders last week and voted to increase its capital stock from $25,000 to $50,000. The reason for this move is the formation of a new electric light company here under the name of the Suffolk Light, Heat & Power Company, with a capital stock of $50,000, and bonds also of $50,000, both of which have been largely over-subscribed.

Tampa, Fla.—The ordinance granting the electric light franchise to John P. Martin, as well as the contract, was passed by the council at its last meeting.

Terry, Miss.—The citizens of this place have voted $12,000 for waterworks and electric lights.

Waukesha, Wis.—An ordinance granting a franchise to the Waukesha Electric Light Company was presented to the council at its recent meeting.

Webster Groves, Mo.—The St. Louis Electric Construction & Maintenance Company has leased and will improve the plant of the Suburban Electric Light & Power Company at this place.

Street Railways.

Altany, N. Y.—Lucian H. Clark, Frederick H. Pouch, Edgar D. Pouch and Bradley J. Bloodgood, of Brooklyn, are directors of the Orange County Traction Company, recently chartered by the Secretary of State, with a capital of $325,000.

Ava, Mo.—The citizens of this place have taken the initial step toward connecting their town by an electric railway line with Cedar Gap on the Memphis division of the Frisco system. It is thought that only $50,000 will be required to build the line, about 14 miles in length.

Centerville, Ia.—The council has granted a 25-year franchise for an electric street railway system, a gas plant, electric lighting plant and a public heating plant.

East St. Louis, Ill.—The right-of-way for the proposed electric line from here to the Mammoth Cave has been secured. The line will be built through Millstadt, Columbia and Waterloo, and later will be extended to Chester through Red Bud.

Exeter, N. H.—Wallace D. Lovell heads a board of incorporators, who have just filed papers with the Secretary of State at Concord, for a charter under the general law for an electric street railway, beginning at a point in Dover, connecting with the Dover, Somersworth & Rochester line, and crossing the Great Bay to Greenland, there to make connection with the new Portsmouth & Exeter line.

Fairmont, W. Va.—A trolley line has been projected between this place and Mannington.

Flint, Mich.—Chicago parties are said to be contemplating an electric road from this city to Long Lake, Fenton and Linden.

Lead, S. D.—A petition is being circulated among the business men asking for a franchise to operate an electric road on the main thoroughfare.

Mansfield, O.—The Mansfield, Savannah & Wellington Electric Railroad Company has increased its capital stock from $100,000 to $1,500,000.

Marinette, Wis.—H. McCallum, city surveyor, will soon start laying out a right-of-way for the interurban electric line between this city and Peshtigo. The cost of the road will probably be $75,000.

San Jose, Cal.—The work of changing the steam motor line from the terminus of the Santa Clara Street Electric Road to Alum Rock Park to an electric service has been begun and will be hastened.

Santa Cruz, Cal.—F. W. Swanton of this city, who represents Eastern capital, has made a proposition to establish an electric railway betwen Monterey and Pacific Grove, and also furnish electric light to both places.

Streator, Ill.—The city council has granted the use of the city to the electric railway for a term of 20 years.

Troy, N. Y.—The new trolley line from this city to Hoosick Falls seems now assured, the consent of 51 per cent. of the abutting property owners along the Stone road in the towns of Brunswick, Pittstown and Hoosick having been obtained. The work of construction will probably be commenced in the spring.

Uhrichsville, O.—C. W. Walter, G. W. Reed, G. H. Sherrard, Fred Ellery, J. Leslie Hillwer, Albert Ellery, W. J. Anderson and G. A. Parr have incorporated the Uhrichsville, White City & Newcomerstown Electric Railway Company of this city with a capital stock of $10,000.

Manufacturing.

New York City.—The Electric & Chemical Manufacturing Company of this city, capitalized at $1,000, has been organized with the following directors: C. W. Fitzgerald, H. S. Dickson and Edward S. Ballon.—The Electric Furnace Company was lately incorporated to manufacture potash, carbide and steel, on a capital of $200,000. The directors are Theron Davis, Thomas Seelye and William N. Barry, all of this city.

Company Matters.

Ackerman, Miss.—The Ackerman Compress, Warehouse & Electric Light Company, with a capital stock of $25,000, will open up business in this place on November 1.

Cleveland, O.—The Electric Compositor Company will be removed to New York. A manufacturing syndicate purchased the interests lately, after being under consideration for several months. R. G. Anderson and J. W. Cummer, who have been connected with the company, will remain with the syndicate.

Flora, Ill.—The Southern Illinois Electric Light Company has changed its name to the Flora Light & Water Company.

Mechanic Falls, Me.—The Mechanic Falls Water & Electric Light & Power Company will increase its power.

Trenton, N. J.—A company that will include a large number of electrical concerns located in the State of Texas will take out papers of incorporation in this State this week. The capital stock of the company will be $1,500,000, all paid in. Interests identified with the combine said that nothing would be given out until its organization has been perfected.

Warren, O.—The Packard Electric Company of this city has reduced its capital stock from $10,000 to $4,000. J. W. Packard is the president.

Power and Transmission.

Bristol, Tenn.—The Ordway Manufacturing Company will erect an electric plant as a feature of the enterprise, the purpose being to furnish electric power to other plants, which will follow the company to Bristol.

Delphi, Ind.—The plans for the construction of a power plant on the Tippecanoe River at Horse Shoe Bend, about a mile and a half above the Springboro bridge, seem to be taking definite form. Chas. Meeker of Lafayette is one of the chief promoters.

Demorest, Ga.—Edward Flox has purchased a water power from J. S. Adams & Sons and will develop same for electrical transmission of power.

Denver, Col.—The Electric Power & Transmission Company, for the manufacture and transmission of electric power to this city, was lately incorporated with a capital stock of $50,000. The articles state that a power plant is to be constructed on the South Platte River, at the junction of the north and south forks, near South Platte station, and that power is to be transmitted from there along the left bank of the river into this city. Henry T. Sale is one of the incorporators.

St. Mary's, O.—The Mandlebaum-Pomeroy Electric Railway Syndicate has let the contract for the erection of a $5,000 power plant at this place.

Windsor, Ont.—F. H. Clergue, of Sault Ste Marie, has practically decided upon the construction of another water power canal to cost upward of $2,000,000. Associated with Mr. Clergue in this enterprise are Messrs. Widener and Elkins, of Philadelphia, who, it is understood, will furnish one-half of the capital. The new canal is intended to develop about 20,000 hp. electricity in the rapids or falls of St. Mary's River, opposite the ship canal.

Automobiles.

Belvidere, Ill.—The management of the National Sewing Machine Company say that beginning November 1 the company will manufacture automobiles.

Cleveland, O.—Bids for the erection of the automobile factory, to be built by the Baker Motor Vehicle Company on Jessie street, have been opened by Architects Meade & Garfield. The contracts have not yet been awarded.

Topeka, Kan.—H. R. Cloughey and W. S. Hannum, of Cherryvale, Kan., have been hero looking for a location for an automobile factory. The automobiles are being manufactured at the present time at Cherryvale.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, October 28, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	35	37
Broadway and Seventh Avenue	100	246	250
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	155½	155¾
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	117¼	117½
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	105	106
Brooklyn City Railway	100	240	242
Brooklyn Rapid Transit	100	60½	60¾
Baltimore United Railways, com	50	16½	16¾
do. do. do. pref	50	91	92
Buffalo Railway	100	110	111
Cleveland City Railway	100	114	115
Cleveland Electric Railway	100	85	85¼
Columbus (O.) Street Railway	100	46	48
Jersey City, Hoboken and Paterson	100	19½	20¼
New Orleans City Railway, com	100	29	31
do. do. do. do. pref	100	104	107
North Jersey Street Railway	100	23½	25
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	30	34
do. do. do. pref	100	85	86
St. Louis United Railways, com	100	25⅞	26
do. do. do. pref	100	79¾	80¼
United Electric of New Jersey	100	17½	20
PHILADELPHIA.			
American Railways	50	40¾	41
Citizens	50	359½	360
Columbus Railway	100	46	48
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	65	67
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23⅜	23½
do do pref	50	62	62½
Dayton Traction	100	156	156¼
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151¼
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J	100	..	..
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	95⅞	96
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	27¼	28
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	178½	179
West End Street, com	50	94	94¼
do. do. do. pref	50	112	113
CHICAGO.			
City Railway	100	200¾	201
Lake Street Elevated	100	11½	11⅝
North Chicago	100	190	200
Union Traction, com	100	15½	16
do. do. pref	100	58	60

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23⅛	23¼
do. do. do. pref	50	64	64¼
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	49	50

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Electric Boat, com	100	19½	21
do do pref	100	45	50
Electric Lead Reduction	100	2⅜	2¾
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	1½	2
do do pref	100	4	5
General Carriage	100	⅞	1
General Electric	100	255	255¼
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	250	251
General Electric	100	259	256¼
Massachusetts Electric Companies, com	100	35⅝	36
" " " pref	100	94	94¼
Westinghouse Electric & Mfg., com	50	70¼	71½
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	161	161¼
National Carbon, com	100	20¼	20½
do do pref	100	83	85
PHILADELPHIA.			
Electric Company of America	50	6½	6⅝
Electric Storage Battery, com	100	68	69
do do do pref	100	85	86
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	5	5⅛
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	93	94
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
BOSTON.			
American Telephone & Telegraph Company	100	159	159½
Erie Telegraph & Telephone Company	100	20	22
New England Telephone Company		133¼	133½
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co	100	105	110
Commercial Cable Company	100	180	185
Franklin Telegraph Company	100	45	54
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	116	118
Mexican Telephone Company	100	2	2⅛
New York & New Jersey Telephone Company	100	168	170
Pacific & Atlantic Telegraph	25	78	85
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		91¼	91⅜
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	116
Cumberland Telephone & Telegraph Co	50	136	140
Chesapeake & Potomac Telephone Company	100	60	65
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		75	76
Hudson River Telephone Company	100	105	110
Northwestern Telephone Company, guar	50	124	126
Providence (R. I) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Oct. 28

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Asked.
Electro-Pneumatic Transit	10	1¼	1½
Eddy Electric Manufacturing Company	25	8	8¼
Storey General Electric	10	12	13
Consolidated Car Heating	100	55	57
Standard Underground Cable	100	218	220
Pratt and Whitney, pref	100	90	95

STREET RAILWAY BONDS.

ALBANY.	Last Sale.	Int. Paid.
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 19,2	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅝@16¾c.; Lake, 16¾@17c.; casting, 16½@16¾c.

Dividend and interest disbursements in Boston during November will aggregate $5,059,061, against $5,902,152 on November 1, 1900.

The National Carbon Company has declared the regular quarterly dividend of 1¾ per cent. on its preferred stock, payable November 13.

Business failures in the United States last week numbered 240, against 205 the same week last year; in Canada there were 29, against 28 last year.

The Syracuse (N. Y.) Lighting Company has declared a quarterly dividend of 1¼ per cent. on its preferred stock, payable November 1.

Papers in the consolidation of the North and West Side street car lines into the Chicago Union Traction Company were filed for record on Friday last.

The New England Telephone & Telegraph Company has declared the regular quarterly dividend of $1.50 per share, payable November 15 to stock of record October 31.

The committee on stock list has recommended that the $45,000,000 capital stock of the Brooklyn Rapid Transit Company be admitted to the regular list of the New York Stock Exchange.

The Staten Island (N. Y.) Electric Railway Company reports for the quarter ending September 30 gross earnings of $79,909, an increase of $1,654, and net $37,806, an increase of $5,706.

Coupons due November 1 from the Kansas City (Mo.) Electric Light Company's consolidated mortgage 5 per cent. gold bonds will be paid at the office of Blair & Co., 33 Wall Street, New York.

The Nassau Electric Railroad Company (Brooklyn, N. Y.) has declared a dividend of 4 per cent. on its preferred stock, payable November 15. Books close November 8 and reopen November 15.

There were quite heavy sales of copper by the United Metals Selling Company last week. On Friday one consumer took 5,000,000 pounds at full prices and total sales for the week are said to have exceeded 10,000,000 pounds.

The Westinghouse Electric & Manufacturing Company has declared the regular quarterly dividend of 1¾ per cent. on its assenting stock, payable November 15. Books close November 2 and reopen November 16.

The Danbury and Harlem Traction Company has been given authority by the New York State Board of Railroad Commissioners to issue a mortgage upon its property for $200,000. The funds are to be applied for new construction.

The American District Telegraph Company has declared a dividend of 1½ per cent, making 2½ per cent. for the year, against 2¼ per cent. in 1900. It is payable November 15. Books close November 4 and reopen November 15.

A new experiment in the use of electric vehicles for transportation of merchandise and passengers in Boston is now being planned, and is expected to be started before the end of the winter. The Armstrong Transfer Company is back of the project.

At a meeting of the board of directors of the Montreal Electric Street Railway, held at Montreal October 23, the annual statement for the year ending September 30 was submitted. The income of the road, over and above expenses and fixed charges, exclusive of dividends, amounted to $649,251, as compared with $647,246 for the year 1900.

At a meeting of the directors of the Boston Elevated Railway Company Monday it was voted to ask the West End Street Railway Company to issue bonds in payment of charges against the West End held by the Boston Elevated for new construction. Total charges for new construction aggregate about $1,800,000.

The New York State Railroad Commission has approved of the proposed $4,000,000 first mortgage bonds issued by the Hudson Valley Railway Company, which operates the trolley road between Waterford, Saratoga County, and Lake George, Warren County, a distance of about 85 miles. All but $50,000 of the bonds will be used to retire existing bonded indebtedness.

The new issues of the Washington Traction Company, deliverable when issued, are, the New York "News Bureau" states, quoted at 82 @ 83½ for bonds, 42@45 for the preferred stock and 22 @ 25 for the common stock. The fixed charges of the company per $1,000 bond have been reduced from $45 to $22, as the old 4½ per cent. bonds received only 55 per cent. of the new 4 per cent. bonds and a certain proportion of new preferred and common stock. It is urged, therefore, that the earning capacity of the company is well within the fixed charges, with a fair margin left for the preferred stock.

The tone of the copper market is quiet at present, but steady on the 17-cent Lake basis. Consumers are busy but understood to be working on contracts closed sometime ago. The future is regarded with some concern, it must be admitted, and people in the trade think that interesting developments are possible between now and next spring. Nevertheless holders are confident apparently, and concessions are as hard to obtain as any time the past 30 days. Representatives of consuming interests recognize the improbability of any immediate change in the selling price of copper also, but at the same time show caution in buying at the quoted prices. Exports are improving slightly and additional shipments of 815 tons copper and 200 tons matte, bring the shipments since October 1 up to nearly 6,000 tons. But the month compares poorly with a year ago when exports in October, 1900, were 12,682 tons.

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THE TRADE SUPPLIED BY
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EDITORIAL NOTES.

Wireless Telegraphy and Ocean Liners.

Although wireless telegraphy may be said to have only graduated from the laboratory some five years ago, it is surprising to note how extensively this method of communication is being adopted where the circumstances permit. As we predicted when wireless telegraphy was, so to speak, in swaddling clothes, its greatest field of usefulness has been found to be in communicating between ships at sea, or between a vessel and the mainland. The steamers of the North German Lloyd Company and the Cunard line are almost without exception provided with Marconi's apparatus for transmitting and receiving messages, and now we hear that the new fast steamer Savoie of the Compagnie Générale Transatlantique is also equipped with Marconi's system. On the other side of the "herring pond" a wireless telegraphy station may be found at the Lizard, while on this side of the Atlantic an enterprising New York daily has provided a similar station on the lightship at Nantucket Shoals. As a result of this, passengers on an up-to-date ocean greyhound may now transmit or receive messages via the Lizard or Nantucket Shoals stations, twelve hours after sailing, or twelve hours before reaching either point. In other words, the transatlantic passage is virtually shortened by a day, which should prove of great value to business men by enabling them to communicate with their associates with a loss of a minimum amount of possibly valuable time. As wireless telegraphy is constantly being improved upon, we shall probably see the day when a transatlantic liner will be out of touch of either one continent or the other for but a few hours.

* * *

The English Railway Investor and Electric Traction.

During the past few months there have been several welcome indications that English railway companies are finding themselves compelled to pay greater heed than formerly to the application of electric traction, writes our London correspondent. We may pass over, says he, with a word, the dispatching of responsible officials to other countries to study developments there, for this sort of thing has gone on for several years with no result of special import. Railway men have produced this, that and the other particular difficulty which stands in the way of the immediate adoption of electricity for their own special systems, and the data compiled has been pigeon-holed for reference at a more convenient season. It is suggested that that more convenient season is almost at hand, for the railway shareholder is likely to exercise a very powerful influence in bringing the application of electricity to a head. One instance is cited of this kind of thing. The proprietors in the London & Northwestern Railway are being invited to express their individual opinions on the following points: (1) What steps should be taken to lighten the serious loss which has fallen upon the stockholders in consequence of the increased costs of working, which have risen since the passing of the Railway Rates Act of 1891? (2) What attitude is to be adopted by the railways in regard to the development of electric traction throughout the country?

The manner in which these two pertinent questions are coupled together in itself affords an indication of the inner workings of the minds of those responsible for the issuance of the circular. Steam railway shareholders hear every year of increased working costs, and diminishing or stationary dividends; they also hear of the directly opposite results happening on electrically-operated lines, and quite naturally they draw one, and only one conclusion. But as every one knows, English railway companies as a whole are about the last concerns to adopt anything in the nature of a revolutionary change. They have nothing beyond their underground (deep-level) lines in London, and overhead line at Liverpool, working electrically so far, but the things on paper are exciting a good deal of public interest, and this affects the mind of the investor of course. The schemes may be briefly mentioned thus:

(1) Manchester-Liverpool (Behr) mono-rail; prospectus comes before the public in a few days.

(2) A projected high-speed electric line between London and Brighton (47 miles), with deep, level tunnels as far as Croydon (12 miles from London). This scheme has made the London, Brighton & South Coast Railway examine its weaknesses, and its officials hint that to fight the new scheme, the company will be prepared to spend any sum of money that may

be necessary to duplicate its lines from London to Croydon by means of tunnels, and to work the service thus far electrically, the existing line being available for express traffic to Brighton.

(3) The Mersey Tunnel Railway, for which the Westinghouse Company has taken the electrical conversion contract under guarantee of completion in 18 months, and providing that the working expenses shall be reduced from 1s. 3d. per train mile to 6¾d.

(4) The Glasgow Subway Railway directors have declared that they will never be able to pay much of a dividend upon the capital until the present system of working has given place to electric traction. It is only a few years ago that the line was opened, and electrical men wondered then why it was that other power was adopted.

(5) The North London Railway (largely owned by the London & Northwestern, referred to above) is mentioned as one of the next London lines to adopt electricity. At the present moment the railway has a splendid business and brings hundreds of thousands of workers into the city from the northern suburbs between the hours of 6 and 10 A. M., and takes them home between 5 and 10 P. M. The railway is well managed and is as convenient as any steam line in or around London. With electric traction, however, it should be able to handle the rapidly increasing traffic from these congested suburban districts far more economically and conveniently than it does now.

(6) There seems every likelihood that the London County Council will go in for shallow subway railways, such as their officials have seen at New York and Boston. It will take a long time to pass any projects through the "preliminary" and parliamentary stages. It appears probable that London will follow somewhat on the lines of the New York Rapid Transit line, although of course, as Mr. W. B. Parsons says, the conditions prevailing in the two cities are totally different.

Railway authorities are continuing to wail over traffic lost through the competition of up-to-date trolley lines in large cities. The same grievance is also being ventilated in Germany just now. In England it will help to hasten railways adopting electricity for the control of local traffic.

* * *

Electrical Trade With Argentine.

The advance which American electrical manufacturers have made in the Argentine Republic during the last two years is shown in the official records of the Treasury Bureau of Statistics, from which it is learned that the exports of electrical machinery to that country increased from a value of $114,733 in 1899 to $215,505 in 1900, while the exports of scientific instruments, telephones, telegraphs, and other electrical apparatus increased from $247,062 to $259,608. The substantial increases in our electrical trade with Argentine are very satisfactory, and are all the more so when the obstacles to our trade with that country are taken into consideration. There are no steamers and only a few sailing vessels that make regular trips to and from any of our ports. We sell the Argentine people good products, and, it might be remarked in passing, they are coming more and more to recognize their superiority; but when ready for shipment they must lie in the dock warehouses of our home ports until, forsooth, some foreign liner or tramp steamer comes along from a European port to take them to their consignees, not handling them too carefully en route, habitually decrying their quality and manner of packing, and sneering at what they term our impracticable business methods, in the vain hope (and vain it is, in view of quality and price) of stemming the current of trade that is setting away from them and toward our country.

In a word, our electrical machinery has a constantly augmenting reputation in Argentine. Wherever our electrical manufacturers are persistently and intelligently introduced by a resident agent, speaking the language, fully acquainted with the habits of the people, and qualified to explain the value, merits and uses of the articles he has for sale, there is no question of our commercial success, even handicapped as we are by the absence of our own shipping to carry our goods and of our own banking houses through which to transact the vast monetary exchanges incident to the commerce we seek.

As constant dripping of water will wear away a stone, so possibly a constant reiteration of these glaring needs may in time cause some of those interested to move to secure them.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

The Pan-American Exposition ended at 12 o'clock Saturday night. President John G. Milburn pressed an electric button at that hour and the lights in the now famous electric tower grew dim for the last time. Slowly, one by one, the lights on post and pinnacle and tower faded away. A corps of buglers standing in the tower sounded "taps" and one of the greatest glories of the Exposition, the electrical illumination, passed away and the show was ended.

◆

The city council of Chicago recommitted the proposed ordinance compelling the City Traction Company to charge only four cents fare for passengers unable to find seats. The ordinance would have been defeated if pressed to a vote. It is the first sign that the extravagant and hostile measures directed against the surface lines will not carry.

◆

The "North American Review" for November contains an article written by Mr. Anthony N. Brady. He makes this prophesy: "Merchandise will soon be collected by electrically operated express wagons, transferred to electrically propelled freight cars and whirled from New York to Chicago at a speed of ninety miles an hour over trunk lines whose problems of electrical equipment and maintenance will have solved themselves."

◆

In Mexico they are about to construct an electric railroad which will be the longest of all the roads now in operation there. It is intended, indeed, that this new railway shall start from Tuxpan and proceed across a great part of the States of Vera Cruz, Hidalgo and Puebla, as far as the capital. The mountainous nature of the ground will offer great difficulties in the construction, but it is expected that these will be finally overcome. As a compensation there are many rivers and torrents which will furnish hydraulic power to develop the electric force necessary for the operation of the road.

◆

A meeting was held in Philadelphia on the evening of November 1, looking to the formation of a national organization to be known as the American Electro-Chemical Society. Representatives of national institutions, and chemists from different parts of the United States were present, and many favorable letters were received, promising co-operation. Prof. Joseph W. Richards, of Lehigh University, acted as chairman. Dr. Charles A. Doremus, of the College of the City of New York, was elected chairman of the committee on membership.

◆

According to a Belgian newspaper the replacement of horse traction by electrical power on the Brussels street railways is about to be actively undertaken. Plans for the power houses have been passed, and there will soon be laid down four machines, each of 2,000 horse-power, for the production of the electric force. In all, eight machines totaling 28,000 horse-power, will be requisitioned, and the work of reconstruction will proceed, section by section, from now till May, 1903.

◆

Several hundred Chicago manufacturers have been offered free sites in St. Joseph, Mich., by the Indiana electric road, which will build from South Bend to St. Joseph next spring.

◆

The Electric Traction Committee of Batley, Yorkshire, has decided to recommend the town council of that English place to let the contract for the laying of the permanent way in connection with the proposed electric tramway to Graham Brothers of Huddersfield. The contract price is over $150,000.

◆

New York automobilists will have the exclusive use of a road one mile in length now nearing completion in the Bronx.

◆

There are many anecdotes told of Lord Kelvin. One, says an English contemporary, concerns a visit paid with a friend to some well-known electrical works. They were escorted over the workshops by the senior foreman, a man of much intelligence and an enthusiastic electrician. Entirely unaware of his visitor's identity, he minutely explained the details of the plant and machinery, and lectured him in his role of layman quite professionally. Lord Kelvin's friend was on the point of interrupting several times, but an amused signal from the great master of electricity kept him silent. When the tour of inspection was complete Lord Kelvin quietly turned to the foreman and asked, "What then, is electricity?" This was a poser for the man, who, somewhat shamefaced, confessed that he could not say. "Well, well," said Lord Kelvin gently, "that is the only thing about electricity which you and I don't know."

◆

Herbert E. Plass, of this city, is the inventor of a portable electric lamp, and he states that it is constructed so that it can be carried in the user's pocket or thrown into a traveling bag without liability to damage either the lamp or contents of the bag. The bulb is set beneath the surface of the case and is further protected by a glass plate across the opening, so there is practically no danger of breakage. The case is fitted with a flexible flap secured with snap buttons, making it convenient for gaining access to the interior to replace the cells of the battery. These cells are three in number and are wired up in such a manner that they can be removed without interfering with the lamp. At the rear of the screw socket which holds the bulb is a switch for controlling the current, a small key projecting through the casing to be operated from the outside.

◆

An electric scoop for grain barges is an invention intended to economize in the number of men necessary to unload grain or other bulk material from barges and other vessels. Under ordinary conditions the grain must be handled several times to shovel it to the mouth of the "elevator leg" used for hoisting the grain to the elevator. The new apparatus applies power to the scoop, thus increasing its size and the amount of work it is capable of performing. An electric motor is used to run the winding drum, the cable extending from the drum to the foot of the elevator and thence to the scoop. On one handle of the scoop is a push-button or other form of switch, which closes the circuit through the motor and winds up the cable to carry the grain to the mouth of the elevator. The great convenience of this manner of handling the scoop is apparent, as the power is applied only when needed, and is within easy control of the man operating the scoop, without the necessity of employing an extra hand to manage the drum.

◆

The American Wireless Telegraph Company is now erecting a station adjacent to the United States Life-Saving Station at Barnegat City, N. J., where many vessels headed for the port of New York and Philadelphia pass. This is also used as a guiding point for steamers from Europe for the southern route because of the light there. From this point, which will be in communication with the upper station at Galilee, important service can be rendered to the Government's life-saving service, and also wireless reports of passing ships can be immediately dispatched to the newspapers, as well as to the Maritime Exchange and wrecking companies. Dr. Gehring, the president of the Wireless Company, not only vouched for the erection of the new station at Barnegat City, but also stated the company and its associated sub-companies propose erecting additiona stations along the entire coast.

◆

It is reported that valuable deposits have just been discovered in various parts of Italy of bannite, which is a hydro-oxide of aluminum. As Italy has hitherto been entirely dependent upon foreign exports for her supplies of aluminum, the discovery is of great industrial importance. The deposits are met with at various points in the Central Appennines, where in some districts they cover an area of not less than 300 acres.

◆

It is often supposed that iron is the only substance which is susceptible of magnetization; further, that iron is always susceptible to the force of magnetism under all conditions. Both of these suppositions are incorrect. Iron shares with nickel, cobalt, and manganese the properties that we associate with the name magnetism, though the three latter metals only possess the properties in a much less degree. Manganese, in fact, has only recently been brought into the magnetic fold. Further, iron, when heated to a temperature of 750 degrees, alters its magnetic properties altogether, its behavior then becoming similar to that of the bodies known as parmagnetic, in which are included metals such as platinum, aluminum, and others in which the magnetic susceptibility is very small, and which have not the property common to the first group, known as hysteresis.

◆

An electric cutter was recently put in the shirt factory located in Butler, Pa. The cutting is done with a circular knife, about six inches in diameter, which makes 2,500 revolutions a minute. It is kept sharp by two miniature emery wheels attached above it. With this machine a man can cut nearly twice as many garments per day as by hand. The power is furnished by a dynamo attached to a gas engine.

◆

During the month of October Appraiser Wakeman, of New York, passed 23 high-class motor vehicles that were manufactured abroad. The foreign value of these was over $80,000, and, with the duty added, the value in this country exceeds $120,000. Last Friday there were 9 motor vehicles at the Appraisers' Stores awaiting examination, ranging from racers to delivery trucks.

◆

An important patent connected with the St. Lawrence navigation is designed specially to do away with the lighthouses, buoys, and the entire paraphernalia for night navagation between Montreal and Quebec, Can., and substitute a submerged electric system which, however, will apply to all inland navigable waters. The main idea is to sink an electric cable in the center of the navigable channels with power transmitted from a power house at Montreal, and lines of colored lights at or above the water level each side of the channel, the lights on one side being of a different color to those on the other side, and supported by cork floats. The patentee is H. J. Cloran, Mayor of Hawkesbury.

◆

The British Post Office has decided to employ women telephonists. In this they have but followed the example of all other administrations and private companies. Women are pre-eminently successful as telephonists. No person at all acquainted with the requirements of the service would hesitate for an instant in the choice between men and women for this service. There is an abundance of evidence obtainable from all parts of the world to prove that women are particularly adapted by nature and social training to perform the work of telephony. Every European State has staffed its telephone offices with girls. Cape Colony, New South Wales and Queensland has done the same, and the employment of women is extending with the extension of the services.

◆

A dispatch from London dated October 29 states that an inquiry into the best system of electrically equipping the underground roads was opened in the Law Courts that day. Alfred Lyttleton, who was appointed arbitrator by the Board of Trade, presided.

◆

Wireless telegraphy seems to have a great future in the Sahara desert, as communication can readily be set up between the oases.

A CADMIUM STANDARD CELL.*

BY HENRY TINSLEY.

Various notices have appeared in the "Electrician" in past numbers as to the feasibility of using a cadmium cell for a practical standard, and in the same paper of September 10, 1897, a notice by Professor Callendar was reprinted which had special reference to such cells and also to a method of construction of the ordinary Clark cell, which eliminated the errors due to diffusion lag in the zinc sulphate solution. The writer has been trying to follow out the ideas advanced in Professor Callendar's paper. More especially the aim has been to obtain a cell which would bear a perceptible current being taken from it without polarizing, and which would bear a short circuit with a certainty of almost immediate recovery without artificial means, such as charging, being used to bring the emf. back to nominal value.

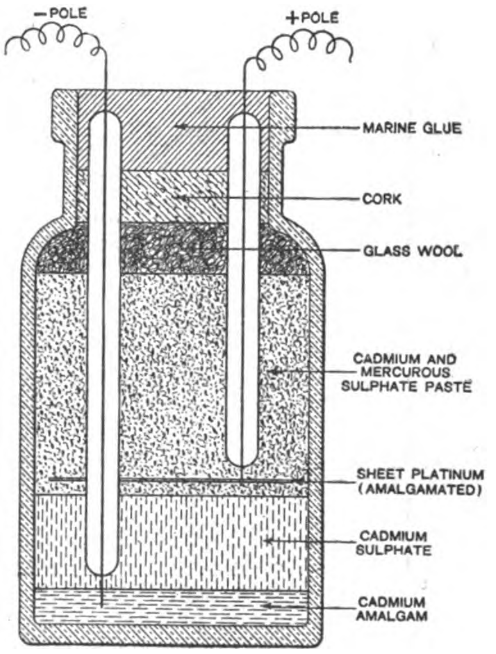

Fig. 1.—Sketch of Cell, Full Size.

After several attempts and also several failures, the cell illustrated in Fig. 1 has been made and proved to fill the above-mentioned conditions to an extent which must be regarded as very fairly satisfactory. A description of the cell may perhaps be repeated which along with Fig. 1 (which is almost a full size sketch of such a cell), will give a clear idea of its construction.

The negative electrode is composed of an amalgam of cadmium and mercury suitably proportioned, above which is a layer of cadmium sulphate. After this is the usual mixture of mercurous and cadmium sulphate crystals, in which is placed an amalgamated sheet of platinum. Connection to this is made by a platinum wire, and the same material is also used to act as a connection to the amalgam. A layer of glass wool prevents the chemicals shifting unduly, and the whole cell is sealed with marine glue. Very little free moisture is present, as Professer Callendar has shown that cells made thus are generally more stable in their emf. under varying conditions of temperature.

The question of an accurate reproduction of these cells is one of the first that rises, and the following table will give an idea as to the great accuracy on this point. These cells were made on different dates and with chemicals from two different makers:

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*From the "Electrician," London.

No.	Volts.	No.	Volts.
31	1.0191	34	1.0192
32	1.0192	35	1.0190
33	1.0191	36	1.0191

The writer attributes this closeness in value as being partly due to the method of only using platinum wire for connections, as soldering usually causes a slight local action, especially if any trace of chemical happens to get on the joint.

The question of low internal resistance is best solved by studying the curve Fig. 2, which was taken on a Callendar recorder working as an automatic potentiometer. A volt box, having a resistance of about 520 ohms, was arranged for the cadmium cell to discharge through, and potential points were taken off, so that a drop of 50 millivolts might fall on the bridge wire. This would correspond to 1 volt across the scale, so that 1-500th of a volt might be easily read.

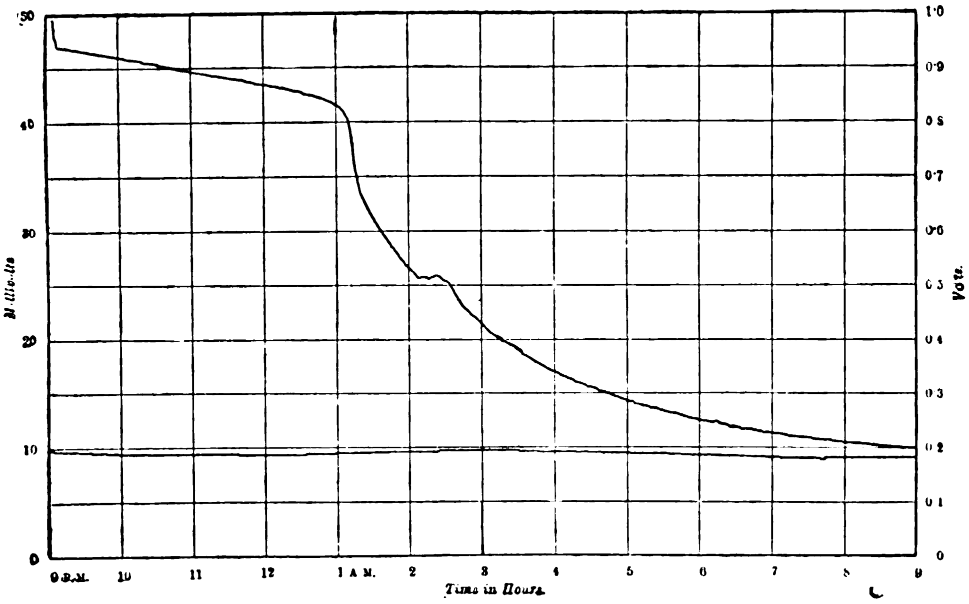

Fig. 2.—Discharge Curve.

Curve No. 1 shows the discharge curve of one of the cells, and we see at once that the primary drop is about 7 per cent., showing that the internal resistance of this cell was only about 40 ohms when sending a current of about 1.8 milliamperes.

During the next four hours a steady fall set in, probably owing to an increase in the internal resistance of the cell, but the current still averaged 1.6 milliamperes. In looking at this curve it is as well to bear in mind the fact that the cell is still sending a current of a fairly large amount; and that the cell has no saving factor of an unduly large internal resistance. The particular cell from which the above curve was obtained has also been previously discharged under similar conditions for at least 24 hours.

The bend over the curve at 1 A. M. is worth noticing and is probably due to the electrode of the cell becoming completely covered with hydrogen. At this point the cell appears to become incapable of maintaining a current of any useful value.

The supposition that this rise in internal resistance is due to the accumulation of hydrogen is strengthened by the curious little flat in the curve at 2:15 A. M. At this time someone walked across the room in which the experiment was being undertaken, and presumably shook the table on which the cell was resting. Any slight shaking such as this is sufficient to liberate the accumulated hydrogen and thus reduce the internal resistance or polarization of the cell. I have noticed the same curious break in at least half a dozen instances. It appears that the slightest shaking is sufficient to cause a release of hydrogen and lower the resistance of the cell. Perhaps this will account for the fact that Clarke cells, when in constant use, keep in better condition than those that stand idle. The healthy condition of used cells is not so much due to the current being allowed to flow through them as to the shaking they undergo during repeated handling, etc.

In the curve we see that after the above noticed flat, the internal resistance of the cell still continues to rise rapidly until after about 12 hours discharge, when apparently a level is reached at which no noticeable increase in resistance or polarization takes place.

I have taken several such curves, but refrain from producing them as the one given above appears to be thoroughly typical of the discharge of one of these cells. From observations I have made I am of the opinion that when once the cell has been allowed to discharge at a point beyond the sharp bend-over shown above, it is somewhat difficult for the cell to regain its normal healthy condition unless a large amount of liquid is present in the cell. Seldom, or indeed never, in practice are standard cells subjected to such a severe strain as to send 1.5 milliamperes for 30 or 40 hours at a stretch; and such cells as that above described ought to be very useful where a small current of, say, about 1 milliampere is required for short periods.

In regard to the recovery after such a long strain, it may be mentioned that an exceedingly quick recovery takes place when first released from a closed circuit, but it takes four or five hours to recover the last 20 millivolts. I have not yet found one of these cells more than a few tenths of a millivolt out six hours after the most severe discharge.

The most serious drawback to the above type of cell seems to be the liability of the cadmium amalgam to dissociate when subjected to heavy jars such as those that happen in the post. This is partly avoided by keeping the other constituents of the cell as solid as possible so that the amalgam is kept down by their weight.

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CONDUCTORS' ACCOUNTS.*

BY ELMER M. WHITE.

The first step is to provide the conductor with a day card that will give the receiving department all the necessary information and at the same time be plain and simple. The less complicated a day card is, the fewer mistakes the conductors will make. The result is that the receiving deparment will find its work easier, for there is no harder or more unsatisfactory work than correcting errors.

It has been our aim to make our day cards as simple as possible and not require the conductor to do anything that could be done better in the office. Our latest change in this line has been to have only one column for tickets; formerly we had three or four columns for different kinds; we cut that down to two, i. e., "Revenue" and "Free," but at last we are down to the one, i. e., "Tickets." We found many times in issuing a new ticket it was necessary to make quite an extended notice for the conductor, explaining what column this particular ticket should go. If it happened to be a land sale ticket, on which was printed free ticket, but for which we receive full revenue, it was rather hard for some of our conductors to remember that a ticket on which was printed free ticket, was to go into the "Revenue Column." The present method saves the conductors from making any errors of entering in wrong column, and the time spent by the ticket counters in separating the various kinds is not as much as time formerly spent in correcting errors.

We use three different kinds of day cards. "A" is our regular city day card, and is used when the fare is only five cents. "Trips From —To" is used for mileage numbers. Our central starting point "City Hall" is "O." We have a table of distances figured from "O" and other prominent points, so that our mileage is very easily figured. The mileage numbers are painted on the poles at all switches and cross-overs and ends of lines, so that a conductor on a new run has no trouble in giving us his destination, although he may be obliged to turn back before reaching the end of the line.

I copy the following in relation to the report of car mileage from our instruction book:

"Conductors will designate on day card the starting point and ending point of each trip by numbers known as 'Car Mileage Numbers;' these numbers are on the trolley poles in red figures.

"It is necessary that the correct mileage of each car be recorded, and to accomplish this conductors must use care in making out report of trips run and be sure that car mileage numbers are down for the beginning and ending of each trip.

"A trip shall be known as the run between any two points, and shall end when the car is ready to return to its starting or some other point. One trip shall occupy one line on day card; the first trip will always begin on first line."

"Starting Time" and "Number of Car" are familiar to all. "Not Registered," "Transfer, Employe and Police." Transfers.—Although a few roads continue to register transfers, we have found it better practice to discontinue this registration. Employes and police ride free on their uniform. A detail of "Not Registered" will be found on the back of the day card. Transfer tickets when collected are put in envelopes and deposited every two trips with a collector who is stationed at a central point. "Fares Registered" includes all passengers not mentioned before, each trip shows the number on register when it is reset. The tickets are entered by trips, but cash fares are only entered as a total.

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*Paper read at the Convention of the Street Railway Accountants' Association of America, held in New York City, October 11, 1901.

"B" is a day card used on our suburban lines where three five cent fares are collected. This is done separately, and the register is reset at each limit. On this day card the conductor fills out "Fares Registered," and the ticket counter "Ticket Summary."

"C" is a a day card used on the Newington division, our line running to New Britain, part of the distance over the tracks of the Connecticut Railway & Lighting Company. As we receive their tickets and transfers a different day card is required; in "Summary," however, the conductor fills out only the cash fares.

The conductor makes up report of day's work, putting cash, tickets and day card in a numbered canvas bag and deposits it in a safe provided for that purpose. This safe opens into the receiving room.

The receiving room is open at 8 o'clock in the morning. First, the money counters take the canvas bag, empty it, counting cash, and if correct, putting their initial on the day card, which is folded so that the amount is outside and no unfolding is necessary. The tickets are folded inside and held in by a rubber band. If cash is not correct it is counted by a second counter, then a short or over slip is made out.

Day cards now pass to the ticket counter, who checks the number of tickets and separates them into "free" "2½-cent" and "5-cent," entering them in place provided on day card.

Day cards are now separated into lines, and checked for trips from a list of the number of trips run on each line made out by the carhouse foreman.

The next step is the checking of registers. The register we use is one of our own make, and differs from any other in that it prints the fares registered whenever set back to "O," as you can see on the register slip. As nothing can be printed except what is visible, it is easy to see that if the conductor does not put down on his day card what the register calls for he can blame no one but himself when he gets called up to settle for a short; he knows that it is up to him as no one else has made any record. By comparing the day card and register slip you can see how readily it is checked up, first the regular then the relief. There is no need of any total when you can check up each trip. We very often find it convenient to know what the register reading actually was on some particular trip, not what some one said it was.

The day cards are now ready to prove; "fares registered" are first added; that total, less the tickets, gives the cash fares; any correction in fares registered is made in colored pencil (each one checking having a different color), but cash fares and cash are always corrected in red ink; a short or over slip is made for these errors. The amount on day card after it is corrected is the amount entered as receipts for the day.

The various short or over-slips are entered on one sheet, which is sent to the assistant superintendent each day for settlement with conductors. The conductors sign this sheet whether they are short or over. We mean to be perfectly fair with our conductors and as willingly send them back what they have overpaid as we look for a cheerful settlement when the mistake is the other way.

The receiver has a fund to draw from when the short and over-balance is on the wrong side, so that we deposit what the corrected day cards call for.

The day cards are now ready to enter by lines, each conductor separately; as soon as all are entered and added the totals of cash are taken and the deposit is made ready for the bank. This is made by the receiver, and agrees with the total cash receipts.

After cash is out of the way the transfer envelopes are checked with day cards, and any differences are reported to the assistant superintendent for settlement.

The totals of various lines are now copied on a sheet which includes car mileage, car hours, transfers, free tickets, ticket fares, cash fares, total passengers, cash receipts, ticket value and total earnings. On this sheet is a record in detail of the cash deposited.

For the year ending June 30, 1901, we carried 14,835,939 paying passengers and 3,122,550 transfer passengers. The expenses of the receiving department to handle cash and tickets was approximately one cent for every hundred passengers. Our daily service calls for seventy one regular cars, with 147 conductors.

I, for one, realize that frequent discussion of prevailing methods and constant watchfulness of details are necessary in the accomplishment of economies, and that free discussion will lead to greater perfection.

MOTOR VEHICLES AND ELECTRICITY WORKS.*

BY W. E. WARRILOW.

The rapid growth of electricity supply schemes into comparatively large undertakings, has brought with it the need of some more speedy method of transit, to meet the demands of the mains department. Lighting areas which extend over many square miles are not easily covered by horse-drawn vehicles, either for the conveyance of the staff (especially in case of breakdowns), or for the cartage of the materials needed on any particular section of work. At the present time the haulage needed on the outdoor work is done either by contractors, or by the Corporation themselves, and of the two the latter is the more speedy, though neither is by any means all that could be desired. The chief causes of this unsatisfactory state of affairs are to be traced to the employment of horses, and the effects their use has upon the driver. The limits of the capabilities of a horse are too well known to need enlarging upon here; suffice it to say, that this otherwise excellent quadruped is fast becoming unsuitable for the speedy haulage of heavy loads. Now, the driving of an ordinary cart horse is such a simple matter, entailing little thought or judgment, that the driver becomes a mere machine, holding the reins and guiding the animal. This simplicity may be desirable in many cases, but in the present instance it produces a stamp of man who detracts from, rather than contributes to, the success of an undertaking. The qualifications of a driver are so small that any man is picked up to do the work, many such men being unable to either read or write. A circumstance in question will serve to illustrate the former deficiency in a carter. A man was told over to remove a load of dirt from a certain street off a main thoroughfare, the fullest instructions being given him as to the whereabouts of the spot. Subsequent inspection found the soil still unremoved, the carter having failed to put in an appearance. On being questioned the following day for his failure to comply with orders, he pleaded as an excuse that he could not read, and was unable to decipher the name of the street to which he was directed. Such an example (which came under the writer's notice), may be rare, and it is hoped that this is the case, though little improvement can be effected while the present artificial conditions obtain. What is seriously needed is the introduction of a system of propulsion which will awaken the drivers to the sense of their responsibilities and necessitate constant watchfulness on their part while at their work. A man in charge of a motor vehicle could scarcely get drunk on duty and expect his machine to go along as usual, though the ordinary horse driver will get drunk or sleep at his work, because he knows that his horse will need very little guidance on his part. The demoralizing effect of such conditions on men who are constantly employed as carters may easily be imagined, while the consequences of such a state of things to the undertaking may be equally well realized. Now, the advances made in the construction of motor vehicles have been so marked in the last year or two that they cannot well be overlooked, especially by engineers holding control over large electric supply undertakings. It is a noticeable feature of all such schemes that particular attention is paid to the provision of up-to-date and efficient machinery at the generating station, with a view to reducing the costs of production, while equally important matters on the outdoor department are oftentimes neglected. It is not advisable that any one section of an electricity supply scheme should be sacrificed for the benefit of any other section, a uniform rate of progress being maintained as far as possible in all departments.

Among the apparently forgotten items, especially on large works, is the question of the cartage of material to and from those districts where large extensions of cable are being laid. The opening of a few miles of trench is not accomplished without the constant plying to and fro of a number of carts, some for the removal of superfluous soil, others for the shifting of stores, and others for the supply of the cable, troughing, bitumen, etc., necessary to carry on the work. The cartage of heavy drums is usually effected by means of a float, though in some cases a cable trolley is used taking up to the largest size likely to be needed. When properly designed the latter reduces the labor of haulage by horses very considerably.

Now the speeds attained by horses with heavy loads are, comparatively speaking, very low, a cart carrying 3 tons seldom reaching more than 2½ miles an hour, a state of things which increases very considerably the cost per week to an electricity undertaking for vehicles on the mains. That these figures for speed can be easily surpassed by a motor vehicle, goes almost without saying, while it can be readily understood that the additional speed will reduce the number of vehicles required to a minimum. Not only would this result be attained, but a marked reduction in the cost would be noticeable, as an examination of the following table will show. The data for the steam wagons are based upon the haulage of heavy goods, not necessarily for use on cable laying, though the weights and speeds serve to illustrate the superiority of the machine over the horses:

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*From the "Electrical Review," London.

HORSES.	MOTORS (STEAM.)*
One horse with 3 tons travels 2½ miles per hour. Keep of one horse per week, 11s.; driver, 22s. Repairs, about 2s. 6d. per week per cart.	One 7-ton lurry = 12 horses; speed per hour, 5 miles minimum, 7 miles maximum; uses 15 lbs. of coke per mile; driver, 28s. per week. Repairs, about £50 per annum; initial cost, about £670.
Cost of each horse and cart complete, £70; total cost for 12 complete sets, £840.	Makers consider one steam lurry capable of doing work equal to the expenditure of £24 per week on horse-drawn vehicles.

*Data supplied by Messrs, Simpson & Bibby, Cornbrook, Manchester. Particulars based on actual experience of steam lurries.

It must not of course be expected that the adoption of motor vehicles for haulage on mains would do away with all troubles, as such an expectation would be unreasonable, to say the least. Motor wagons have not yet attained perfection, though the present types only need a trial in order to illustrate their capabilities, and call forth improvements as occasion demands their introduction. The steam motor certainly carries the palm for simplicity, and it possesses an undoubted advantage when used on electricity works, that in case of breakdown, it can be handed over to the fitting staff at the station, who will be familiar with the principles underlying its construction, and able to carry out the repairs needed. Again, there need be no difficulty in training the majority of horse drivers to manipulate the wagon, although they could not be expected to undertake any repair work. By the adoption of such a course the standard of driver would considerably improve, as greater attention would be demanded of the man in controlling his vehicle, and a consequent sharpening up of his faculties would result. Not only this, but the presence of a vehicle propelled by machinery would instill into the driver the necessity of becoming more closely acquainted with the working parts, a circumstance which would probably result in his ultimately being able to take entire charge of the wagon, and undertake small repairs. The standard of workman would thus be raised by promoting a keen interest in the work done. This is sorely needed nowadays, when it is becoming more and more the custom to make men into machines, by giving them control over some detail in a large system, whereby their views are narrowed, and their hopes of progress or enlightenment small.

There is another aspect in which the application of motor vehicles to mains work can be viewed. When several miles of extension are in hand, it is necessary to employ gangs of from 30 to 50 men. The extensions in question will be located, perhaps three or four miles from the generating station, at which place the time office will be situated. Now it is the usual practice for the men to walk out to the trench where work is in progress, and book on at the cabin, which is temporarily employed as a time office. The checks are subsequently taken up to the works by one of the men who will be generally told off on the job. In cases where the men cannot take a tram (at workmen's rates) they will have to walk a considerable distance, and should they be late will perhaps get quartered when they arrive at the cabin. At the close of the day's work, the men will have to tramp the same distance home again after toiling for 10 hours in the trench; even though walking money is allowed, the effect on the men will be the same, and in many cases they will not turn out every morning to be at the cabin at 6. They find that there is too much work attached to the job, and naturally they cannot stand the continual strain. Now if motor vans were employed, the men might book on at the works at 6 prompt, and be taken down on, say, a couple of wagons to the trench, while in the evening they might be returned to the works by a similar means.

Such a course would possess at least three distinct advantages; the men would turn up more promptly every day to their work and feel more fit on arriving than if they had to rise two hours earlier and walk; the time-keeping would be confined to the chief office at the station and no delay in the daily returns would be occasioned; the men would work more heartily in that they would realize that their interests were considered with a view to affording them greater facilities for reaching the trench. There would be no difficulty in arranging matters so that the wagons could take the men to and fro, and the small cost would be well saved by the additional work which would be forthcoming from the men. During the rest of the day the wagons, of course, would be employed for the haulage of material, etc.

The above remarks deal with the employment of motor wagons by corporations, but in conclusion a word must be said to contractors who hire out horses and carts. It is essential that these contractors should realize at the earliest opportunity that the motor wagon is now a serious competitor with the horse-drawn vehicle, and where it has been the custom for a man to hire such vehicles to corporations, say, for work on the mains, it is to his interest that he be not left behind in the race for first position.

He must fully understand that the conditions of the present day demand that work should be carried out as economically and expeditiously as possible, and as long as he sticks to inadequate methods of haulage, he must expect to be left behind. He can ill afford to bear the loss which serious competition with motor vehicles would occasion him, so that he must look to it that he adopts up-to-date methods. The purchase of one or two vehicles would enable him, by the additional custom he would obtain, to dispense with the remainder of his horses, and finally carry on his business with the motor-driven vehicles.

An Automatic Generator of Electricity.

A Parisian scientist is said to have patented an automatic generator of electricity for supplying current to the automobile as it runs. It is claimed that a few teaspoonsful of water only are required for generating the necessary motive power and that the French Government is so favorably impressed with its operation that it is considering the advisability of its use on naval vessels. It would be interesting to learn more about this wonderful invention.

BRAKES IN RAILROAD AND STREET CAR SERVICE.*

BY F. M. NELLIS.

In presenting this paper the author does not wish to be held as presuming to advise or dictate to railroad officials what they shall do in the matter of air brake practice, or to lay down hard and fast rules for the guidance of employes; but instead, he offers gratuitously for what it is worth, this practical experience of a specialist to the consideration of the officer and employe seeking information on the subject of railroad and street car brakes. So far as it is possible to make it, the paper has followed lines in the nature of a resumé of some of the things seen by the writer while serving in the capacity of traveling inspector and instructor for the Westinghouse Air Brake Company on the different railroad and street car lines of the country, in yards, shops, roundhouses, and while riding on locomotives, cars and in cabooses. The experiences herein given are those resulting from being brought into close contact with men of all the different operating departments who have to do in any way with brakes, from the general manager down to the repair man in the shop and the inspectors in the yard and in the roundhouse. A person who has thus enjoyed the unusual advantages in this field and been placed in a position to learn other people's opinions, observe their methods and practices, will learn and see things which contribute to an experience that another individual not a specialist could not soon acquire. It is believed that the citing of actual happenings, which may properly be called object lessons, will attract more attention and leave a more lasting impression than could a mere exposition of logical beliefs, be they ever so sound and persuasive. Therefore effort has been made to have this paper follow more nearly the lines of a running narrative of actual occurrences than of an expositional essay.

It has been generally conceded for some time past that the railroads of the East are somewhat tardy and behind those of the far West in air brake maintenance. This is only natural and to be expected when we recollect that the freight train brake had its introduction on the mountain grades in the far West nearly ten years before it was seen to any extent in the East. Necessarily these Western roads were early obliged to provide for the maintenance of the brakes upon which they soon learned to become dependent for controlling their trains down heavy mountain grades. The East, not having these conditions, was later in applying air brakes to freight trains, and also tardy in making systematic preparations for maintaining air brakes. Of course, more or less has been done by Eastern roads in air brake maintenace, but not in as systematic and organized manner as is now being contemplated.

Much money can be squandered on air brake maintenance, and will not bring the desired net results if it be spent in a promiscuous, intermittent or spasmodic manner. The returns will be meagre and unsatisfactory. Efforts improperly directed, though well meant, are analogous to the working of a machine of low efficiency—the intake is maximum and the output minimum; and the machine is therefore discouragingly and, perhaps, ruinously extravagant and expensive. Some roads, in a false feeling of security, believe their air brake practice and methods of maintenance are complete and satisfactory because they do not receive in the manager's office any reports derogatory to their methods; but should a close investigation be made of air brake doings in testing and repair yards, roundhouses and shops, a large number of roads would find that their machine of air brake practice and maintenance is working at very low efficiency. What is first and more needed than anything else, perhaps, is a candid recognition of the fact that the air brakes in freight train service to-day are not receiving the attention they should.

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*Abstract of paper presented before the New York Railroad Club Sept. 26, 1901.

An honest appreciation of this condition, and an organized and systematic effort to better look after the road practice and air brake maintenance will result in a wonderfully improved showing, as well as increased safety and a better movement of trains in heavy traffic. This may seem idle and dogmatic argument, but it is a true statement, and is made only after actual and deliberate observation of the facts.

An instance to illustrate this case may be cited of a certain so-called New York road which, six years ago, had no air brake organization. Every shop and terminal point had its own individual and strongly asserted opinions, ideas and methods of air brake maintenance and practice. The air brake results obtained were quite similar to those general results some few years ago on roads where each division master mechanic was permitted to build such locomotives as he saw fit to design. There was no system, no uniformity, no co-operation in air brake matters—only each man following after his own peculiar ideas, which practice did not seem to result in much good, but served rather to set up a petty, selfish competition against neighboring terminal points, very much to the detriment of the railroad company's interests. One terminal point seemed to strive to establish a certain kind of superiority of its own by degrading its neighbors' methods and practices rather than by attaining a higher standard for itself. Yet this road sought to pose as having a thoroughly established system for care of air brakes. Gradually, however, it was brought to see that the pot-pourri of ideas and practices was not singly or collectively the best, and that something much better could be had for less money. The pleasing assurance is here given that this road, ever since its conversion, has had one of the best systems of air brake practice and maintenance of any of the roads running into Jersey City. It might be added that this illustrated case is not at all an exceptional or isolated one, but only one of many actually observed by the writer in his travels.

The question may be asked: What are we to do to better our air brake service, which we are so candidly informed is not up to the highest standard? How are we to give more attention than we have been accustomed to give this single branch of the many under our charge which go to make up the great whole in modern railroading? The details of railroad operation are becoming so numerous nowadays as to prohibit a close study and supervision of all of them. How are we to give any more of our already over-taxed attention to any single branch, no matter how important that branch may be? These questions have ofttimes been asked, are answerable, and are unmistakable symptoms of a healthy spirit which shows appreciation of actual conditions and a readiness to strive for improvement. The reply to these answers may be summed up in a few words, namely, procure the services of a first-class general air brake inspector, give him full authority in everything pertaining to air brakes, and hold him responsible, having him report directly to the superintendent of motive power or the general superintendent. In this way the machine will be made to work at its full efficiency. The man selected for the position, however, must be the right man in the right place. In regard to brake inspection and maintenance the greatest stress should be laid. No pains should be spared to see that the valves and cylinders are in good condition, and that only the best grease is used, while cleaning and testing should be done in the most approved manner.

Perhaps one of the strongest appealing features in air brake practice to the railroad manager, and one which speaks intelligibly and forcibly in a language of dollars and cents, is that of slid-flat wheels. The removal of a pair of slid-flat wheels, pressing the wheels from the axle and replacing them with newly fitted wheels, is quite an expensive operation and is well understood and appreciated by railroads.

The causes of slid-flat wheels are not entirely due to the poor handling of brakes by the engineer, or the neglected condition of the triple valve, as is generally supposed to be the case. Many wheels coming from foundries, upon examination, will be found to be eccentric in form. Recently, while passing through a prominent railroad shop, the writer observed a pair of wheels mounted on centers in a lathe, where revolving emery wheels were turning down the periphery of the newly mounted car-wheels on the axle. The emery wheel failed to touch or clean up one side of the periphery, but was grinding off nearly three-eighths of an inch from the opposite side. Had this wheel gone into service before being trued up it certainly would have been flattened. Again, many wheels are not bored centrally, due to the faulty condition of the boring mill, and perhaps the condition of the cast wheel coming from the foundry. On wheels that are out of round and that are eccentric the brake-shoe will catch and hold, as can readily be seen, thereby causing the slid-flat spots, which, when once started, are bound to increase and grow longer. Some new wheels when sent from the foundry are found to be shelled out on the periphery, and after running a short time will develop a flat spot without ever having been slid.

Another prolific source of flat wheels is that of the bad condition of the rail in foggy, frosty or snowy weather, thus reducing the adhesion between the wheel and the rail when brakes are applied. A number of prominent roads throughout the country have been able to largely avoid trouble under these conditions by issuing an order that the engineer in applying brakes shall make two applications of the brake in making a stop—the first a heavy application to check the speed of the train, and the final application, a lighter one, to bring the train to a standstill. This practice has been found very effective.

Sometimes slid-flat wheels are caused by disordered air-brake apparatus, defective parts of the triple valve, etc., and improper proportion of leverage. The defective parts of the air brake must be sought out and their disorders corrected. The calculations of leverage, however, is a little more difficult, and is not within the ability of all men having to do with air-braked cars to figure. The following rule will be of assistance to anyone wishing to calculate the brake leverage on the car:

$$W = \frac{P \times a}{b}, \text{ where}$$

W = the work done by the lever.

P = the power giving the energy to the lever.

a = that part of the lever in inches between the points of power and fulcrum.

b = the distance in inches on the lever between fulcrum and work points.

The rule holds good regardless of whether the levers be first, second or third class. In fact, classes of levers should not necessarily enter into the computations of levers for cars.

Hard brake-shoes which wear far too long a time do not give as good actual braking service as do softer and shorter-lived shoes. However, the Master Car Builders' recommendations in this respect may be profitably and advantageously adopted. In substance they are: A brake-shoe which has a reasonable life and good holding quality. There are some brake-shoes on cars throughout the country which give almost as little retarding force to the wheels as if one smooth surface of glass were rubbed upon another. A prominent private car owner in one of our large Western terminals, when approached by a brake-shoe representative, replied that it was a matter of supreme indifference to him whether the brake-shoes on his cars had any retarding power or not so long as they kept their place on the brake-beams and passed inspection in yards. It was found that the brake-shoes on this owner's cars were of the hardest kind purchasable, and furnished an exceedingly low coefficient of friction. Otto Best, the general air brake inspector of the N. C. & St. L. Railway at Nashville, Tenn., made a characteristic remark that the brakes on his locomotive tenders always held. He said he knew this because the brake-shoes always wore out rapidly. This is but reasonable, for we must expect that if we are to receive benefits from anything in mechanics, there must be an equivalent output and that all will not be profitable return without outlay.

Speeds of electric cars have greatly increased over the old horse cars of several years ago. In this fast-moving age we scarcely realize the significance of urban and interurban street car speeds. Not until we have some occasion to compare the fast modern electric car with the belated, slow horse car, which seems to painfully crawl along, do we realize the increase in speeds which electric street cars have attained in the past ten years. It is not an unusual thing at all for trolley cars in city service to reach speeds of 20 and 25 miles per hour, and not at all unusual for electric cars in suburban and interurban service to reach as high as 35 and 40 miles per hour. When we realize that a car moving at 30 miles per hour covers 44 feet in one second, and, with its load, represents a mass of surprising moving energy to be reduced and annulled, it becomes apparent that such cars should be equipped with high-grade brakes of some kind. Power brakes, of the character used on steam roads, naturally present themselves to one's mind when considering this problem.

Successful and sufficient street car brakes, of whatever type they be, must have at least three essential, strong points: First, the brake must be unerringly able and always in condition to stop the car. Second, it must have a capacity for stopping the car in the shortest possible distance in emergency cases. Third, it must perform its work with minimum shock to passengers and danger of sliding wheels. It has been very wisely and truthfully said that brakes on street cars should really be of a higher grade than those on steam cars, inasmuch as street cars are quite frequently loaded to their fullest capacity with loads double the light weight of the car with persons who are entirely helpless in case of an occasion demanding the stopping of the car almost instantly to prevent accident. Besides having sufficient braking force to stop the car in ordinary service work, an ample reserve should be held to be instantly and substantially drawn upon for emergency contingencies.

In no class of brake work in which the writer has had experience are there more inefficient and grotesque designs of foundation brake gear than those appearing on the old horse cars, and, strange as it may seem, on many of the electric cars still coming from the shops of some of the leading manufacturers. One of the most common kind found on four-wheeled horse cars, and existing still on a number of four-wheeled, and even eight-wheeled electric cars, is that shown in Fig. 1. Here the "equalizing lever" is fulcrumed to a bracket on the car at the point X. At the further ends of the lever are chains and rods running to the hand brake. At the intermediate points are the connecting rods which go to the brake beams on the wheels. It will be seen that should a new brake shoe be added to one pair of wheels, or the brake shoes on one pair wear faster, the greater portion of the brake power would be thrown to the other wheels, thereby causing them to slide. This defective gear has evidently been recognized by either the car builder or the road operator, and an attempt made to overcome it by adopting the modification shown in Fig. 2. Here the lever is slotted at the middle point in order that it may "adjust" or "equalize" the power sent to the two pairs of wheels. However, this modification does not improve the defect, but is fully as faulty as the original design; for as soon as the brake is applied by the motorman on the forward end of the car, the lever assumes the position shown in Fig. 3, thus giving two lever arms of unequal lengths, the greater force being thrown on the rear wheels. Should the car be going in the opposite direction, and the brake applied from the other end, the lever will assume the opposite position, and the wheels on the other end would slide, due to the greater pressure being exerted thereon. It will therefore be seen that instead of this slotted lever "equalizing" the stresses, the fixed fulcrum allows the slotted lever to settle itself in a position which gives a greater pull on one truck than on the other.

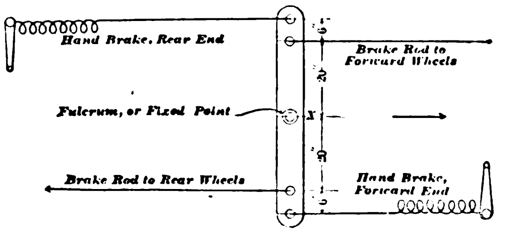

FIG. 1.

During the last six months the writer had occasion to apply an air brake to an interurban electric street car, and found this type of foundation brake-gear on the car; it was only after much urging that the manager of the road could be persuaded to change the type, although he had numerous slid-flat wheels on his cars. The motormen, conductors and shop inspectors had observed that it was always the wheels under the rear end of the car that slid. A change to a modification of the ordinary Stevens form of brake-gear, similar to that used on freight cars, proved a very creditable brake on this car, and no flat wheels have been reported since.

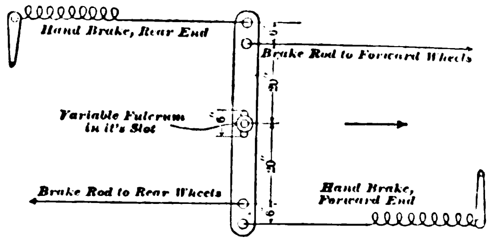

FIG. 2.

Fig. 4 shows another modification of this type of brake-gear, which actually does equalize through the medium of the pulleys on both ends of the lever. As will be observed, the lever is fixed at the fulcrum point X to the car, and has two sheaves or pulleys on which runs the chain reaching to the connecting rods to the trucks. Thus each truck or pair of wheels is given an equal braking power. The degree of braking power in this type of brake is determined by the length of the lever arm between the fixed X fulcrum and the outer end where the hand brake chain connects. This is a simple and quite effective form of brake.

Hand brakes on electric cars, having followed closely in the path of those on the old horse cars, necessitate a great deal of handle movement to wind up the slack in the chain and bring the brake-shoes against the wheels. This slack motion in the gear increases as the brake is designed to be more powerful; and some suitable arrangement should be made to hold the brake shoes as near as possible to the wheels while not doing duty, in order that the least possible winding motion of the brake staff shall be necessary to apply the brake as quick as possible in emergency cases. It is not an unusual thing, on some suburban electric lines, to see the motorman, after he has shut off his current, make two or three revolutions of his brake crank and staff before any retarding effect manifests itself. When we recollect that a car running at a speed of 30 miles per hour covers 44 feet in one second, we will be ready to appreciate the fact that the brake chain and foundation rigging slack should be as little as possible, and that the car should be brought to a stop as quickly as possible in emergency cases after the motorman begins to apply his brake.

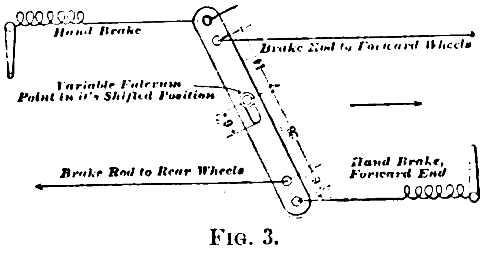
Hand Brake
Brake Rod to Forward Wheels
Variable Fulcrum Point in it's Shifted Position
Brake Rod to Rear Wheels
Hand Brake, Forward End

FIG. 3.

There are other forms of street car brakes which may be classed as part hand brakes and part power brakes. That is, a brake which is set in operation by a movement of the ordinary brake crank in the hands of the motorman, and, by the employment of a revolving drum or disk on the car axle,' the brake chain is wound up, and the inertia of the car thereby converted into the motive power which stops the car. This type usually consists of the ordinary foundation brake gear, which is pulled to its place by a revolving drum or disk on the axle which winds up a chain and gives a pull to the rigging. This system is not wholly without faults, inasmuch as the degree of braking force varies suddenly and widely, and is not entirely under the control of the motor man or any other regulating power. A great many flat wheels have resulted from systems of this kind. Another form of brake, not altogether without faults, is the track brake. When the motorman wishes to bring his car to a stop, he lowers the friction-shoe to the rail, lifts the weight of the car and its load off the wheels, and throws it on to the shoe, which drags on the rail, and thereby produces the retarding effect.

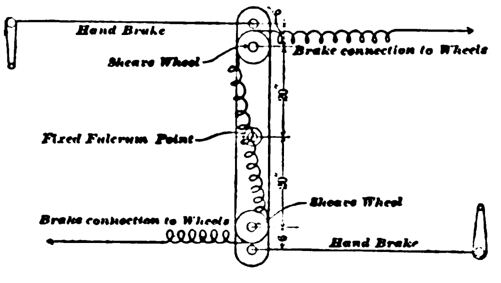

FIG. 4.

With the advent of the heavy electric car, the question of power brakes naturally followed, inasmuch as conditions more nearly approached those on steam roads. The first kind of power brake to present itself was the straight air brake, where the pressure for braking purposes was carried in a tank. When it was desired to set the brakes the pressure was let into the brake cylinder, thereby producing the motive power for operating the foundation brake gear, bringing the brake-shoes against the wheels and stopping the car.

So far, the field of power brakes has almost entirely been occupied by the simple, straight air brake, the automatic brake being regarded as too complicated and expensive for trolley car service. There are a number of cars equipped with the straight air brake now running on electric lines throughout the country and giving satisfactory results. Some of these are supplied with pressure by an axle pump, and others by motor driven pumps. However, when we consider the extreme crudeness of the old form of hand brake on horse cars, and which has followed, to a very large degree, the development of the electric car, we can but realize that any form of a power brake, no matter how crude or partially efficient, would be required to supplant the old form of hand brake. The writer's experience in applying power brakes to street cars has been that the motorman will gladly herald any form of power brake which relieves him from the manual operation of the old brake staff, and wherever the straight air form of air brake has been applied to cars motormen are loud in praise of it.

Thus far the necessity for using some kind of power brake on electric cars in urban and interurban service has been recognized as manifestly desirable and necessary by street railway managers, but no power brake seems to have possessed all the desirable features and at the same time shown itself free of the shortcomings and defects of the older and primitive designs. Shorter stops have been made in some instances with power brakes, but only at the expense of slid-flat wheels; in some instances these brakes were so unreliable in their application that they could not be depended upon. The first consideration with a street car manager in the matter of car brakes is that the brake shall be positive in its action. This is a more valuable feature than maximum power. A brake which will throw too much pressure on the wheels, slide them and allow the car to skid ahead into a wagon, truck or person is not a successful and reliable brake for street car service.

The type of brake known as the electromagnetic brake seems to possess many meritorious points. The brake is a combination track and wheel-shoe brake. The middle part of the double track shoe is an electromagnet. When current is sent through the coil the brake-shoes are attracted to the rail, causing them to drag back on the car, at the same time thrusting back against a lever, which throws the rear brake shoe against the wheel, where a fulcrum is thereby provided, and further energy goes to the upper connecting thrust rod, which pushes the forward shoe against the wheel. Thus a braking power is derived in a double measure, from the track-shoes and the wheel-shoes. The current used to magnetize the shoe is supplied by the motors of the car, which when the line current is shut off, become generators and send current to the electromagnetic track shoes. A proper system of resistance is supplied, which permits the motorman to graduate the braking power as he sees fit.

It will be seen that at high speeds the current generated by the revolving armature is high, and will more highly magnetize the shoe, thereby furnishing greater retardation than when the speed of the car is slow. Thus a very heavy braking force may be had at high speeds, gradually reducing as the speed of the car and the revolutions of the armature reduce, until finally, when the car approaches a standstill, the current sent to the electric magnet gradually grows less, ultimately dying out altogether. This seems to be an ideal brake feature, and one which insures the maximum brake force at high speeds, when it is needed, and which gradually and automatically reduces as the speed of the car reduces, thereby eliminating all chance for slid flat wheels. Thus the brake is able to regulate the braking force to existing conditions, such as bad rails produced by mud, fog, humidity, frost and snow, insuring safety from slid-flat wheels. The hand brake is retained on cars thus equipped, so the car may be held on a grade without use of the line current, and to hold the car on side and shop tracks, as is the custom on air-braked cars of steam railroads.

In addition to the current from the armatures of the motors supplying motive power to the brake, the heat due to the resistance in both starting and braking is used to heat the car. No line current is used for either braking or heating. On a very cold day a year ago last winter, while the writer was riding on a car equipped with this magnetic brake and heater, the car proved much more comfortable than others ridden in on that day that were heated with coal and coke stoves and line current.

One of the most interesting experiences with this car was an offer to allow it to run away down a 4 per cent. grade. The brake handle was put in first service notch, and the car permitted to start. It proceeded but a few feet when the current sent out by the armature of the motor as a generator sufficiently magnetized the shoe to render the brake operative, and the car came to a standstill. It had scarcely stopped before it started forward again down the grade, but the current generated by the armature of the motor as a generator again magnetized the brake-shoe, set the brake, and stopped the car. This operation continued for nearly a mile, and was given as an exhibition to show the impossibility of the car running away on a down grade when the brake is applied.

ELECTROLYTIC TELEPHONOGRAPHS.

As every loose contact, and also any variable current, even, that passes through the electric arc, may be made to speak, and since Poulsen and Petersen have succeeded in obtaining magnetic telephonic records available for reproduction, it is not surprising that we should hear of electrolytic telephonographs, says "Engineering," London. The idea occurred simultaneously to Prof. Nernst, of Gottingen, and to one of his students, R. von Lieben, and the latter is continuing the researches, so far with rather indifferent practical success. Yet the subject is in itself interesting. The first arrangement used was a direct adaptation of the Petersen device to electrolysis. An endless belt of platinum is moved by an electric motor over two pulleys. From below presses gently against the belt a little wedge of wood, placed in a small electrolytic cell. The transmitting microphone is placed in the primary of a transformer, whose circuit comprises five accumulators. The electrolytic cell, with its one electrode, and the platinum belt and battery belong to the secondary circuit, which is closed by means of a switch, for receiving records, and joined to a telephone for reproduction. The leading idea was that the local electrolytic polarization, impressed upon the moving belt, could be utilized in the same way as the magnetic polarization in the Poulsen experiments. This proved, indeed, perfectly possible, and sometimes the electrolytic records could be used for several hundred repetitions. But the effect is not purely an electrolytic one, and its nature remains to be established. For the sounds became the clearer—within limits, of course—the stronger the constant current supplied by the battery, which, as we mentioned, is inserted in the secondary circuit. These constant currents would be superimposed upon the polarization currents, and it is not directly clear why their strength should intensify the telephone sounds, as the telephone responds only to the current fluctuations. There might be a contact resistance effect increasing with the current strength; but the polarization of the different experiments was of a varied nature, as will be seen. The investigators incline to the belief that the strong microphone currents produce a kind of mechanical loosening of the respective portions of the metallic belts, and this effect alters the polarization capacity; the friction between the parts would thus be varied, a circumstance to which Edison and others have long since drawn attention. R. von Lieben modified the arrangement as follows: Instead of the platinum belt, which gave trouble by bending, he used a copper disk, 2 millimeters thick, 450 millimeters in diameter, placed between two iron disks, and turning between centers, which served as conductors. The speed could be varied by employing a pulley resting edgeways on the disk.

The copper rim, the essential part of the device, is carefully turned and polished. A wooden wedge, with an edge about 0.5 millimeter thick and 0.75 millimeter broad, bears against the rim. As electrolyte there was employed copper or zinc sulphate, acid, neutral, or alkaline; the alkaline solutions, especially the zinc sulphate to which caustic potash was added, answered much better than the copper solution, but the zinc hydrate gradually clogged the wedge; wiping, however, cured the trouble. In these cases copper or zinc, or both was deposited on the copper rim. In other experiments the rim was first silvered, and a small silver electrode was placed in the wedge cell, and silver cyanide employed as electrolyte; in others, again, the electrode was platinum, the electrolyte iodide of potassium. The deposits on the rim consisted of silver, hydrogen, or oxygen. The noises accompanying the gas generation disturbed the reproduction of speech, and, on the whole, the experiments were more successful when the copper disk, with its rim of copper or silver, was made the cathode than when it formed the anode.

OBITUARY.

Joseph Virag.

It is with deep regret that we chronicle the death of Mr. Joseph Virag, who passed away in Budapest last week after a short illness with a virulent fever. The famous Hungarian engineer was only 31 years old. In conjunction with Mr. Pollak he made a wonderful improvement in rapid telegraphy, and their invention was about to be adopted by all the telegraph companies of the world.

Edgar P. Seiger.

Edgar P. Seiger, engineer in charge of the Westinghouse interests in Ithaca, N. Y , died Sunday at the City Hospital in that city. His death was due to blood poisoning which resulted from opening a small pimple on his face with a pin last Thursday. Mr. Seiger was graduted from Cornell with the class of '98. His home was in Chicago.

Prof. C. Walton Swoope.

Prof. C. Walton Swoope died October 7th after a short illness. At the time of his demise he was director of the electrical department of Spring Garden Institute at Philadelphia, Pa., and to provide instruments for the use of the pupils he established the Palmer Electrical Instrument Company. Prof. Swoope was the author of a book entitled " Lessons in Practical Electricity." In years past he was an occasional contributor to the columns of ELECTRICITY.

THE Great Northern Telegraph Company has notified the Commercial Cable Company that the Siberian land lines are restored, and messages for China and Japan are now accepted.

PERSONAL MENTION.

President Greatsinger says there is absolutely no truth in the rumor that he is to retire from the Brooklyn Rapid Transit Company.

Mr. A. V. Abbott, formerly chief engineer of the Chicago Bell Telephone Company, is now connected with the Century Telephone Construction Company of Cleveland, O.

Mr Howard T. Sands, formerly superintendent of the Mechanic Falls (Me.) Light & Power Company, has accepted the superintendency of the Lewiston and Auburn Electric Light Company.

Exports of Electrical Material from New York

The following are the exports of electrical material, from the port of New York, for the week ended October 23:

Antwerp, 17 packages, $952; 1 case, $45; Argentine Republic, 42 packages, $2,607; Australia, 156 packages, $33,130; British West Indies, 3 packages, $351; 10 bundles copper wire, $674; Brussels, 3 cases, $340; Bilbao, 1 case, $200; Brazil, 27 packages, $2,476; Bremen, 3 cases, $76; British Guiana, 93 packages, $2,923; Copenhagen, 6 packages, $153; China, 16 packages, $461; Chili, 13 packages, $263; Central America, 22 packages, $262; 8 bundles copper wire, $99; Cuba, 133 packages, $4,412; Dutch East Indies, 1 package, $14; Ecuador, 3 packages, $70; Florence, 5 packages, $442; Gottenburg, 7 packages, $150; Glasgow 12 packages, $1,130; Havre, 48 cases, $5,975; 47 packages, $5,431; Hamburg, 19 packages, $745; Japan, 33 packages, $4,516; Liverpool, 224 packages, $18,839; London, 316 packages, $9,183; Liege, 1 package, $45; Newcastle, 27 cases, $7,000; Peru, 22 packages, $348; Riga, 1 case, $50; Rome, 4 cases, $483; St. Petersburg, 13 cases, $405; U. S. Colombia, 6 cases, $509; Venezuela, 1 case, $41; Vienna, 33 packages, $3,950; Wiborg, 1 package, $14.

The following are the exports of electrical material from the port of New York for the week ended October 30:

Antwerp, 20 packages, $1,899; Australia, 1 package, $10; Bolton, 6 packages, $520; Berlin, 14 packages, $100; Baden, 5 packages, $750; Brazil, 8 packages, $351; Bremen, 3 packages, $148; Bristol, 14 packages, $1,123; British East Indies, 35 packages, $5,316; British Possessions in Africa, 88 packages, $5,643; British Guiana 2 packages, $17; Bucharest, 1 package, $30; Central America, 15 packages, $301; Cuba, 176 packages, $6,146; Dutch East Indies, 4 packages, $72; Ecuador, 2 packages, $89; Florence, 8 packages, $532; Genoa, 1 package, $67; Hamburg, 35 packages, $2,260; Havre, 5 packages, $366; Liverpool, 175 packages, $13,987; London, 365 packages, $20,193; Manchester, 35 packages, $3,465; Mexico, 316 packages, $10,221; New Foundland, 8 packages, $206; Nova Scotia, 12 packages, $1,000; Peru, 118 packages, $2,188; Rotterdam, 5 packages, $131; Santo Domingo, 6 packages, $232; Southampton, 128 packages, $1,297; U. S. Colombia, 2 packages, $30.

INCORPORATIONS.

The Long Island Motor Company, Brooklyn, N. Y. Capital stock $100,000.

The Central Electric Company, La Crosse, Wis. Capital stock, $25,000. Incorporators: R. B. Gilott, J. E. Willing, Jr., and George S. Carill.

The Church Motor & Launch Company, Nyack, N. Y. Capital stock. $25,000. Directors: O. C. Pinckney, Grand View on Hudson; H. C. Cornwall, Millburn, N. J., and B. W. Church, Mystic, Conn.

The Trinidad Electric Company, Ltd., New York—to acquire the Trinidad Electric Light Company and the Belmont Tramways, now operating in Port au Spain, Trinidad, British West Indies. Capital stock, $1,500,000. Stockholders: F. T. Pearson, Sir William Van Horne, 80 Broadway, this city, and others.

The Carstarphen Electric Company, Denver, Col. Capital stock, $15,000. Incorporators: William P. Carstarphen, Jr., Frederick C. Hardon and Frank E. Carstarphen.

The Houston Electric Company, Houston, Tex.—to operate an electric line. Capital stock, $2,075,000. Incorporators G. C. Baldwin, C H. Tyler and T. W. House.

The United Railway & Light Company of Wilmington, Dover, Del.—to furnish light, heat and power for electric railways. Capital stock, $1,000,000.

The Benton Light & Power Company, Fort Benton, Mont. —to engage in the business of furnishing power and light, and may also construct telephone lines. Capital stock, $15,000. Trustees for the first three months are C. E. Duer, Charles Lepley, W. K. Harber, James Townsend and L. D. Sharp.

The Southwest Gas & Electric Company, Los Angeles, Cal. Capital stock $1,000,000. Incorporators: H. Fisher, F H. Sinclair, W. R. Statts, J. H. Holmes, J. S. Cravens and W. S. Wright.

The Murphysboro & Carbondale Electric Railroad Company, Murphysboro, Ill. Capital stock, $50,000. Incorporators: William Jens, T M. Logan, A. L. Ritter, E. F. Harper, D. M. Browning and W. S. Forman.

The Inter-Ocean Electric Construction Company, Trenton, N. J. Capital stock, $8,000. Incorporators: John C. Kome and E. J. Bingle, 44 Broad street, and K. K. McLaren, 15 Exchange place, Jersey City.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCT. 29, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

685,242. Electric Railway. Riccardo Arno and Aristide Caramagna, Turin, Italy. Filed April 21, 1897.

685,395. Car-Fender. Andrew M. Cupples, Tyrone, Pa. Filed July 19, 1901.

685,575. Electric-Railway Trolley. Edward R. Coon, Burlington, Vt. Filed May 25, 1901.

685,616. Car-Fender. Lowry S. Kirker, Wheeling, W. Va. Filed June 19, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

685,295. Contact-Key for Sockets of Electric Incandescent Lamps. Guy H. Proctor, Somerville, Mass. Filed May 15, 1901.

685,426. Electric Arc Lamp. John A. Mosher, Chicago, Ill., assignor to the Adams & Westlake Company, a Corporation of Illinois. Filed March 25, 1901.

685,486. Controlling System for Electric Lamp-Heaters. Henry N. Potter, Gottingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Filed Aug. 9, 1899. Renewed April 27, 1900.

685,487. Ballast Cut-Out for Electric Lamps. Henry N. Potter, Pittsburg, Pa., assignor to George Westinghouse, same place. Filed July 14, 1900.

685,488. Heater Cut-Out for Electric Lamps. Henry N. Potter, Halensee, Germany, assignor to George Westinghouse, Pittsburg, Pa. Filed Aug. 15, 1900. Renewed Sept. 6, 1901.

685,512. Method of Treating Nernst-Lamp Glowers. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, same place. Filed April 24, 1900.

685,528. Heating Device for Electric Lamps. Henry N. Potter, Gottingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Filed Sept. 11, 1899.

685,724. Method of Electric Lighting. Walther Nernst, Gottingen, Germany, assignor to George Westinghouse, Pittsburg. Pa. Filed April 28, 1898.

685,725-686,727-685,728. Electric Glow-Lamp. Walther Nernst, Gottingen, Germany, assignor to George Westinghouse, Pittsburg, Pa Original application filed April 28, 1898. Divided and these applications filed May 29, 1899, April 10, 1901.

685,726. Electric Lighting Apparatus. Walther Nernst, Gottingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Original application April 28, 1898. Divided and this application filed Nov. 7, 1999.

685,729-685,732-685,733. Glower for Electric Lamps. Walther Nernst, Gottingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Filed Aug. 24, 1899. Renewed April 13 1900. Filed Nov. 8, 1900.

685,730. Material for Electric-Lamp Glowers. Walther Nernst, Gottingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Filed Aug. 24, 1899. Renewed June 18, 1901.

685,731. Ballast Device for Electric Glower-Lamps Walther Nernst, Gottingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Filed Sept. 29, 1899. Renewed June 30, 1900.

ELECTRICAL MACHINERY AND APPARATUS.

685,279. Switch Controlling Device. George H. Hill, Glenridge, N. J., assignor to the Sprague Electric Company, New York City. Filed Aug. 5, 1901.

685,286. Magneto Electric Generator. John S. Mead, Buffalo, N. Y., assignor to Albert W. Courtney, Buffalo, N. Y. Filed March 18, 1901.

685,314. Electricity-Meter. Roger S. White, Chicago, Ill. Filed Aug. 24, 1901.

685,326. Electric-Elevator Hoisting Mechanism. Thomas W. Eaton, Chicago, Ill., assignor to the Eaton & Prince Company, same place. Filed March 26, 1901.

685,393-685,394. Electric Brake. Perley P. Crafts, Boston, Mass., assignor to the Algonquin Electric Brake Company, same place. Filed Nov. 30, 1900.

685,485. Rheostat. Thomas S. Perkins, Idlewood, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Nov. 9, 1900.

685,507. Switch for Electric Circuits. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Nov. 9, 1900.

685,516. Mounting and Driving Dynamos on Cars. Patrick Kennedy, Brooklyn, N. Y., assignor to the Consolidated Railway, Electric Lighting & Equipment Company of New Jersey. Filed Feb. 5, 1901.

685,590. Electrical Indicator. Harry Faltermayer and Frederick W. Faltermayer, Philadelphia, Pa. Filed July 19, 1900.

685,604. Electric Switch. John W. Hearn, Brooklyn, N. Y Filed Jan. 22, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

685,401. Universal Call-Circuit and Apparatus for Toll Service. Angus S. Hibbard, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed June 27, 1901.

685,685. Power-Generator for Telephones. Ernest Krahenbuhl, San Rafael, Cal. Filed July 7, 1899.

685,715. Secrecy Telephone System. Frank A. Cumings, Greersville, O., assignor of one-half to Wilson Morris, Loudonville, O Filed April 19, 1901.

MISCELLANEOUS.

685,274. Electrolytic Decomposing Apparatus. Max Haas, Aue, Germany. Filed June 14, 1900.

685,278 Battery. Gustavos Heidel, St. Louis, Mo., assignor of one-half to Gustav Miller, St. Louis, Mo. Filed Aug. 20, 1900.

685,301. Telegraph-Key. Charles Shirley, Brooklyn, N. Y., and John F. Skirrow, East Orange, N. J. Filed Aug. 6, 1901.

685,390. Printing-Telegraph. John E. Wright, New York City. Filed Oct. 5, 1900.

685,431. Magnetic Device for Use in Alternating-Current Circuits. John Pearson, St. Paul, Minn., assignor of one-half to James F. Williamson, Minneapolis, Minn. Filed Feb. 19, 1901.

685,470. Winding for Electromagnetic Spools or Coils. John A. Heany, Philadelphia, Pa., assignor to the Teter-Heany Developing Company, same place, and Charleston, W. Va. Filed Oct. 18, 1900.

685,471. Thermo-Electric Couple. Eugene Hermite and Charles F. Cooper, Paris, France. Filed Feb. 23, 1901.

685,472. Process of Manufacturing Copper-Sulfid Rods for Thermo Electro Couples. Eugene Hermite and Charles F. Cooper, Paris, France. Original application filed Feb. 23, 1901. Divided and this application filed Aug. 20, 1901.

685,494. System of Electrical Distribution. Norman W. Storer, Edgewood Park, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Sept. 6, 1900.

685,503. Wheel-Gearing for Transmission of Power. George S. Baker, London, Eng. Filed June 10, 1901.

685,549. Electric Cut-Out. Alexander J. Wurtz, Pittsburg, Pa., assignor to George Westinghouse, same place. Filed April 17, 1901,

685,571. Telegraph or Other System. John Burry, Fort Lee, N. J. Filed Oct. 28, 1899.

685,577. Apparatus for Regulating Electric Generating Systems. Albert De Dion and Georges Bouton, Puteaux, France. Filed June 4, 1901.

685,603. Screw-Driver for Securing Insulators in Place. Archie Henry, Meadville, Pa. Filed May 23, 1901.

685,613. Switchboard and Fuse-Box. Montgomery H. Johnson, Utica, N. Y. Filed March 26, 1900.

685,614. Support for Electric Push-Buttons. Henry F. Keil, New York City. Filed Feb. 13, 1901.

685,658. Driving Mechanism for Automobiles. Rollin H. White, Cleveland, O., assignor to the White Sewing Machine Company same place. Filed Dec. 3, 1900.

685,717. Electric Furnace, Oscar Frolich, Steglitz, near Berlin, Germany, assignor to the firm of Siemens & Halske Aktien-Gesellschaft, Berlin, Germany. Filed Sept. 27, 1898.

685,720. Electric Fan. Gardner C. Hawkins, Boston, Mass., assignor to Boston Electric Heating & Power Company, Portland, Me., and Boston, Mass. Filed Jan. 24, 1901.

THE TELEPHONE WORLD.

Independent Telephone Company for Nashville, Tenn.

An independent telephone company has applied for a charter in Nashville, the home of the Cumberland Telephone Company's system. The application was made several days ago, and from the list of incorporators there is little doubt but that a new system will be flourishing in the State capital within a few months. One of the peculiar facts in connection with the establishment of the new company is that it is backed financially either by Memphis capital or those who are interested in the new company that is soon to be put in operation in Memphis.

Among the most prominent of the incorporators is Hon. Harvey Myers, of Covington, Ky., who is the president and one of the most important backers of the new Memphis Telephone Company. Then there is Frank O. Smith, who is secretary and chief engineer of the Memphis system. Besides these, there is W. A. Percy, of Memphis, a director of the local company, and J. S. Aisthorpe, the manager of the Halliday interests in Cairo, Ill., who practically own the independent company in that city

The effect of this company on Memphis will be, that the local system working in harmony with it, will open long-distance connections between the two cities and the surrounding towns. This has been definitely decided upon, and as soon as the two companies get into working order the lines will be stretched. This opening is what the independent company has been looking for for some time, and consider it quite a victory to get an entrance into Nashville so soon.

In the meantime work is going along rapidly in Memphis, and it is only a matter of a few weeks before the subscribers will have their telephones in working order. The new building on Monroe street is rapidly going up and will soon be ready for occupancy. It is to be used as an exchange and also as the central office, and the architect asserts that it is a model of its kind, being in accordance with all the latest improvements in that line.

The Wood County Telephone Company, the co-operative telephone system in Grand Rapids, Wis., is enjoying phenomenal success, especially in demands for 'phones, and it has been found necessary to provide for the great increase. It has purchased a modern metallic switchboard of 400-drop capacity, so arranged that it may be increased to 1,000 or more. It has also purchased and placed a large number of new poles and copper metallic cables to provide the necessary room and capacity on all main leads from the central office. When this change has been completed the Wood County Telephone exchange will be wholly metallic. This exchange, which is one of the many throughout the Wisconsin Valley on a strictly co-operative plan, is proving a great success in every particular.

St. John's, N. S., will follow the example set by Halifax, and if permission is granted by the common council will this fall lay wires underground in King street, Market Square and Chipman's Hill. The desire of the New Brunswick Telephone Company is to have all the cables to the new telephone exchange on Chipman's Hill enter from below the surface of the ground. If the work is carried out, tubular conduits will be laid for the purpose of holding the cables, which will run down the poles and enter the conduit. The company has applied to the city for permission to put the wires underground.

An additional step in the work of covering Indiana with a lacework of mutual telephone lines was taken last week when the Big Springs Co-operative Telephone Company filed articles of incorporation and announced its intention to operate in the counties of Boone, Hamilton, Clinton, Marion and Montgomery. The capital is $200, and the directors are: J. O. Parr, J. W. Reed, W. E. Beatty, E. H. Stephenson and A. C. Poppino.

Calvin M. Seeley, local manager of the Sunset Telephone Company, makes the statement that Los Angeles, Cal., can now claim the distinction of having more telephones according to population than any other city of the United States. There are now in use in that city 10,342 telephones.

An increase of 35,320 instruments in the net output of the American Telephone & Telegraph Company for the month ended October 20 makes a net increase of 172,621 instruments for the 10 months of the fiscal year.

The Eastern Construction Company has completed one circuit for the Dauphin County, Pa., Telephone Company. It is expected to have 600 telephones in service by Christmas.

A. S. Churchill is contemplating putting up telephone wires between Searcy and Pangburn, Ark.

Independent People Now United.

A new telephone sign has been adopted by the independent telephone interests of Michigan, and in the future a uniform insignia will be used by all the independent telephone companies in that State. The new sign was determined upon at a meeting of representatives of the independents at Saginaw, which was attended by Manager C. E. Tarte and Secretary E. B. Fisher of the Citizens' Telephone Company of Grand Rapids. There were also representatives of the Valley Telephone Company, having headquarters at Saginaw, and controlling the independent telephone field in the Saginaw Valley of the Union Telephone Company, with headquarters at Alma and operating in the central part of the State, and of the People's Telephone Company, now building exchanges in Detroit and Jackson.

The new sign, which is the design of C. E. Tarte, of Grand Rapids, bears a solid blue shield on a white background. The words "Independent Telephone" are above and below the shield, which bears the words: "Local and Long Distance" in white letters. This insignia will go into use at once.

The Pacific States Telephone & Telegraph Company having found that its means of communication between San Francisco and Oakland, Cal., are inadequate, is busily engaged in supplementing the same on a large scale with a view to giving its patrons the best possible service. There are now 33 circuits in use between both cities, and to these have been added a number of cables between San Francisco and Goat Island and 14 more wires between Goat Island and Oakland. A cable is also being strung across Goat Island. When these cables shall have been added to the complement now in force, the management says that it will be able to handle in a satisfactory manner all the business of its patrons.

The directors of the Snickersville, Va., Telephone Company have decided to extend the line from Bluemont to Upperville by way of the "Trappe," and Bloomfield, a distance of 12 miles, and put 13 'phones on it. This will put the line in connection with Warrenton. Many other points in Fauquier will be connected. The company will then have about 35 miles of wire, and 40 or 50 'phones. The central office in Leesburg will also be in touch with all these places, and the entire county in audible connection with the outside world.

That every effort is being put forth by the People's Telephone Company to insure the citizens of Jackson, Mich., its excellent service is demonstrated by the energetic and painstaking manner with which its work is being carried on in every department. The company has placed 'phones on exhibition made by the Kellogg Switchboard & Supply Company of Chicago, and are pronounced by experts as superior apparatus.

Last Saturday the new Cortlandt street telephone exchange of this city was put in service. This exchange is equipped with the largest common battery switchboard in the world, and is the last of the exchanges in Manhattan to be converted from the old system of working to the new.

The citizens of West Concord, Minn., are putting the finishing touches to a first-class telephone system. They already have about 50 subscribers, and when they decide with which long-distance line they will connect, will undoubtedly have nearly double the number.

The Pioneer Telephone Company of Cleveland, O., and Detroit, Mich., has been in Elmira, N. Y., negotiating for the operation of its lines through that point to cities further East. The plan of the Western company is to effect a traffic arrangement in Elmira.

The independent telephone people of Hutchinson, Kan., intend to have their line in working condition by the first of December or before. Workmen have been busy putting poles in position, and in a short time some wire will be stretched.

A charter of the Citizens' Telephone Company of Lone Oak, Tex., with a capital stock of $41,000, was lately filed. The incorporators are W. W. Patillo, W. C. Bellah, W. G. Patterson and others.

A charter has been granted the Richland Telephone Company of Grainger County, Tenn.

The farmers west of Lancaster, Ia., are putting up a telephone known as the People's 'Phone.

The Painesville, O., Telephone Company will lay its wires in conduits underground.

Increased Capital Stock.

According to the Columbus, O., "Dispatch," the Central Union Telephone Company has notified its stockholders that the capital stock has been increased from $3,481,000 to $10,000,000.

The notice in speaking of the company states that on October 18, 1901, there were over 90,000 central system telephone stations connected up by the company's plant, and nearly 50,000 orders on hand, as compared with 75,341 such stations connected up on May 1, 1901.

It is understood that the additional funds will be used in extending the lines of the company, and there is a possibility a number of the competing lines will be absorbed.

Just what effect the securing of this additional capital will have on local conditions cannot be ascertained, as but little of the new issue has been subscribed for at this time. Under the rulings of the board stockholders will have the preference in doubling their stock in the company.

A report from Chariton, Ia., claims that Lucas County is better supplied with telephones than perhaps any other county in that State. There are now 19 telephone lines operating in the county and every township in the county now has one or more telephones running in, while nearly every farm house is now supplied with a telephone. All of the companies save the Iowa Telephone Company which runs into Chariton are mutual affairs, and all run into the Chariton central office, giving the farmers connection with almost every county in the State.

The consolidation of the Pennsylvania Telephone Company of Harrisburg with the Central Pennsylvania Telephone Supply Company, which it purchased recently, has been effected and two new officers have been appointed. Mr. J. E. Wilkinson has been made auditor and Mr. John S. Furst, toll agent. Mr. Furst was formerly secretary of the Central Company with offices at Williamsport. They will have offices at Harrisburg. The dividend rate has been raised from 5 to 6 per cent.

Work was lately begun on the construction of the telephone line to Leboeuf, Pa. This will be a great convenience to both Waterford and Leboeuf people. The service to Waterford, Millvillage, Cambridge Springs, and all country subscribers in those neighborhoods, will be free to Leboeuf subscribers, and they will also have the advantage of the low rates to long distance points offered by the Union Telephone Company.

News from Minneapolis, Minn., affirms that the switchboard at the south exchange of the Twin City Telephone Company is completed. Everything is in readiness for connecting up subscribers. It is expected that 600 subscribers will shortly be connected.

It now looks as though a telephone line would be built through Nippenose Valley, Pa.

The Holston Telephone Company is extending its lines and otherwise improving the property owned by the company in Carter County, Tenn.

TELEPHONE INCORPORATIONS.

The Otsego County Telephone Toll Line Company, Cooperstown, N. Y. Capital stock, $10,000. Directors: John Geer, L. Barker and John A. Losee, Richfield Springs.

The Manhattan Telephone Company, Manhattan, Ill. Capital stock, $2,400. Incorporators: Benjamin J. Baskerville, Dennis Hogan and August Tennyson.

The Interstate Telephone Company, Spokane, Wash. Capital stock, $20,000. Incorporators: M. A. Phelps of Spokane, Joseph Fisher of St. Maries, Idaho, and Fred W. Haverland of Toledo, O.

The Piedmont Telephone Company, Piedmont, W. Va.—to construct and operate telephone lines. Capital stock, $10,000. Incorporators: J. T. Lanklin, Luke, Md.; J. S. Jamison, Westernport, Md.; C. D. Webb, Timothy Kenny of Piedmont; and E. Boynton, of Barnum, W. Va.

The Tennessee Telephone & Telegraph Company, Nashville, Tenn.—to build up a telephone company in Nashville and extend it over the State. Capital stock, $10,000. Incorporators: Sanford Duncan, Geo. I. Waddey, Charles H, Brandon, C. R. Handly and John B. Keeble.

The Protivin Telephone Company, Protivin, Ia. Capital stock, $4,000. Incorporators: Frank J. Fenel, John Fenel, Joseph Bouska, Fred Lukes, Frank Kalishek, Albert M. John Kesh, Bouska and John A. Dostal.

The Trans-Texas Telephone Company, Caldwell, Tex. Capital stock, $10,000. Incorporators: J. D. Giddings, J. S. Giddings and Robert S. Leonard.

GENERAL ELECTRICAL NEWS.

Lighting.

Albion, Idaho.—This place is soon to have electric lights.

Barron, Wis.—This city has made a contract with the Barron Manufacturing Company to purchase its water power for electric lighting and waterworks purposes.

Brockville, Ont.—An electric light plant of 200-light capacity will be put in at this place.

East Peoria, Ill.—This place is soon to let the contract for lighting the village by electricity.

Hyattsville, Md.—The common council held a recent meeting, and by previous arrangement the board of trade was present, and through its president, N. A. Dunning, presented and advocated the passage of an ordinance granting Wallace R. McLean, of Washington, John R. Toppen, of New York, and Robert W. Wells, of this place, a franchise for the operation of an electric lighting and power plant here.

Jasper, Ala.—This place is negotiating for waterworks and an electric light system.

La Crosse, Wis.—Merchants of the business part of the city will organize a new private electric lighting company to light several blocks.

Newport News, Va.—An announcement is made that the Consumers' Light, Heat & Ice Company of this city will expend $250,000 here in the next few months in enlarging its electric light plant and building a large ice plant and cold storge warehouse.

Norwich, Conn.—Incandescent lights are to be installed here in the place of the oil lamps used previously.

Onalaska, Wis.—If the plans of several La Crosse capitalists materialize a new electric lighting and power plant will be in operation in this village within a few months.

Ritzville, Wash.—This place is to have electric lights. C. O. Greene has been given a 25-year franchise, and a first-class plant will be put in at once.

Skowhegan, Me.—The lighting plant of the Skowhegan Electric Light Company is soon to be greatly increased by installing one large new machine to take the place of four smaller ones now in service.

St. Charles, Mo.—J. D. Houseman, manager of the St. Louis, St. Charles & Western Railway Company, has purchased the incandescent electric light plant of this city from A. D. Williams, and will operate it in connection with the power house of the electric railway in this city.

Suffield, Conn.—The backers of the Suffield Street Railway have purchased of the village water company its entire plant and stock, and will hereafter be sole owners and managers of the plant, which includes both the village water service and the electric light service.

Union, N. Y.—The trustees of this village are thinking about submitting the matter of lighting the town with electricity to the voters.

Wichita Falls, Tex.—The electric light plant here has changed hands, E. A. Clousnitzer having sold the same to W. L. Berger of Geneseo, Ill., for $8,500.

Street Railways.

Aberdeen, Wash.—A secret meeting of the business men was recently held and preliminary action taken in regard to building an electric railway between this city and Hoquiam a distance of four miles.

Albany, N. Y.—The Elmira & Waverly Railway Company was incorporated recently with a capital of $1,200,000, to construct an electric road between Elmira and Waverly, Tioga County, a distance of 18 miles.

Batavia, N. Y.—The Buffalo & Williamsville Electric Railway Company was recently granted a franchise by Highway Commissioners Torrance, Harris and Uphill to build its road through this town.

Brockville, Ont.—Surveyors have been in this locality laying out a route for a proposed new electric railway between Toronto and this place. The new line will also extend to Ottawa and Cornwall, and it is proposed that the line will shorten the distance between Toronto and Kingston by 35 miles.

Frankfort, Ind.—The Frankfort & Indianapolis Railway Company was organized to construct an electric road between this city and Indianapolis. The officers are as follows: President, D. F. Allen; treasurer, D. A. Coulter; secretary, J. A. Hedgcock.

Geneva, O.—The Luttle-Goodrich Company is still bent on building an electric line between this place and Painesville and stock to the amount of $10,000 has been subscribed to that end.

Guthrie, Okla.—The Secretary of the Territory has granted a charter to the Lawton & Mount Scott Transportation Company of Lawton. The company proposes to build an electric line from Lawton to Mount Scott in the new National Park, with a branch to Fort Sill and one to Sulphur Springs. The capital is $50,000. The concern was incorporated by O. A. Shuttee and E. F. Mitchell of El Reno and others.

Huntsville, Ala.—A party of business men will soon begin a survey of land for an electric railway line to Monte Sano.

La Crosse, Wis.—From word received from Black River Falls the La Crosse, Black River Falls & Neillsville Electric Railroad will be built next summer. John S. Owen of Eau Claire, who is the owner of the Black River Falls Power Company, is making extensive improvements in the power and when these have been completed the surplus power will be sufficient to operate the railroad between this city and Neillsville.

Marietta, O.—The Washington County Traction Company has been organized here with a capital stock of $250,000.

Mishawaka, Ind.—An electric road is proposed from here to Michigan City, Ind. The projector is William Osgood Orton.

Mount Holly, N. J.—The power-house of the trolley line operated by the Pennsylvania Railroad Company between here and Burlington was burned last week. The loss is estimated at $40,000.

Norfolk, Va.—There is a project to construct an electric road from here to Elizabeth City, N. C.

Northport, N. Y.—This place is to be connected by trolley with the East Northport station of the Long Island Railroad, a distance of two and seven tenths miles. Upon the request of the people here the railroad company has agreed to construct the line. All necessary franchises, so far as the town is concerned, have been granted, and the plans for the new line are now before the State Railroad Commissioners for their approval.

Paulsboro, N. J.—Messrs. Peall and Stretmatter, who are developing a suburb of Paulsboro, are working out plans for a system of trolleys, running from Mullica Hill, Swedesboro, Bridgeport and other places, and centering at Paulsboro Ferry.

Phillipsburg, N. J.—The proposed trolley between this city and Washington is again being agitated, and the latest report is that the general master mechanic of the Lehigh Traction Company has publicly stated that the road will be in operation at a not very distant date and that a private right of way has been secured.

Piedmont, W. Va.—The Piedmont & Keyser Electric Railway Company has been incorporated to construct a road from West Virginia Junction, through Luke, Md., and to Keyser. The principal office will be here. Wilson M. Foulk is president, Thomas W. Gocke secretary, and John Mackie treasurer.

Pittsburg, Pa.—An electric street railway is projected from this city to Wheeling.

Plattsburg, N. Y.—The proposed trolley road from Lake Champlain via Keeseville and Ausable Forks, to Lake Placid, which has been under consideration for some time, is now said to be a certainty.

Readsboro, Vt.—There is some talk of an electric road from here through Heartwellville to North Adams.

Salamanca, N. Y.—The Salamanca & Little Valley Railroad Company has been incorporated, with a capital of $400,000, to construct an electric road, 14 miles long, connecting this place and Little Valley. The directors are: A. E. Darrow, F. E. Kelly and T. Champlin of Little Valley; Hudson Ansley, Fred R. Adams and Edward Bolard of this place; Thomas Lathrop, Clifford Hubbell and John S. Rockwell, of Buffalo.

Manufacturing.

Cincinnati, O.—The Bullock Electric Manufacturing Company will equip an electric railway in Porto Rico, and probably in the Philippines.

Montreal, Can.—The directors of the Wire & Cable Company, Limited, have decided to erect a large factory for the construction of electric cable The new building will be situated on Lesignan street.

New York City.—The New York Switchboard & Manufacturing Company was lately formed for the purpose of manufacturing and selling of electric apparatus, on a capital of $4,000. Ernest Ohnell, Peter Gran and A. P. Anderson, all of this city, are interested in the concern.

Syracuse, N. Y.—Pass & Seymour, manufacturers of electrical supplies, are spending several thousand dollars in improving and enlarging their plant in the western end of this city.

Company Matters.

Alton, Ill.—The Davis-Jewett Electric Company has been dissolved, Mr. Jewett retiring. The firm in future will be known as the Davis Brothers' Electric Company, Mr. Ralph Davis having entered partnership with his brother.

Athens, Ga.—Last month a deed was filed in the office of the clerk of the superior court conveying the property and franchises of the Tallassee Power Company to the Athens Electric Railway Company.

New York City.—The following changes in the officers of the Electric Storage Battery Company were recently made: Herbert Lloyd, formerly first vice-president, was made president, vice George H. Day, resigned; George D. Widener, formerly second vice-president, was made first vice-president; John R. Williams, formerly third vice-president, was made second vice president. The office of third vice-president has been temporarily abolished.

Sac City, Ia.—The Sac City Electric Company will increase its capital stock from $15,000 to $20,000.

Power and Transmission.

South Manchester, Conn.—The Riter-Conley Company of Pittsburg, Pa., is constructing a penstock to divert the falls of the Connecticut River at this place, so as to operate an electric power plant, which will drive all the cotton mill machinery of the Manchester district.

Wadesboro, N. C.—The Bluitt Falls Electric Power Company, the principal office of which is to be in Wadesboro, has been chartered lately. Mr. F. J. Coxe, of this place, has been looking after the incorporation of the new enterprise, and said that it has for its principal object the harnessing of the Pee Dee River at Bluitt Falls in Anson County, so as to develop the vast water power there for the generation of an electric current. The capital stock of the new company is $250,000, and it has far-reaching rights in the construction of dams, reservoirs, mills, factories, lines for transmitting power to Wadesboro, Rockingham, etc., also is empowered to issue bonds.

Automobiles.

Chicago, Ill.—Twenty-two automobiles, valued at $50,000, sent to this city from Honolulu to be repaired, were destroyed in a fire in the building occupied by the Wood Motor-Vehicle Company last week.

Jewett, O.—The motor carriage works will erect a manufacturing plant here.

Pasadena, Cal.—A meeting of prominent men of this city have incorporated an automobile and bicycle livery stable company, with the intention of starting out with one automobile as a public carriage, and to increase the number as the trade may demand. The capital stock is $25,000.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, November 4, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	35	37
Broadway and Seventh Avenue	100	246	250
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	155	155½
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	117¼	117½
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	105	106
Brooklyn City Railway	100	240	242
Brooklyn Rapid Transit	100	63	63¼
Baltimore United Railways, com	50	15⅜	15½
do. do. do. pref.	50	91	92
Buffalo Railway	100	110	111
Cleveland City Railway	100	114	115
Cleveland Electric Railway	100	85	85¼
Columbus (O.) Street Railway	100	46	48
Jersey City, Hoboken and Paterson	100	19½	20¼
New Orleans City Railway, com	100	29	31
do. do. do. do. pref	100	104	107
North Jersey Street Railway	100	23½	25
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	30	34
do. do. do. pref	100	85	86
St. Louis United Railways, com	100	25⅞	26
do. do. do. pref	100	79¾	80¼
United Electric of New Jersey	100	17½	20
PHILADELPHIA.			
American Railways	50	40⅝	41
Citizens	50	359½	360
Columbus Railway	100	46	48
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	65	67
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23⅜	23½
do do pref	50	62	62½
Dayton Traction	100	156	156¼
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151¼
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	95⅞	96
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	27¼	28
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	178½	179
West End Street, com	50	94	94¼
do. do. do. pref	50	113	113¼
CHICAGO.			
City Railway	100	200¾	201
Lake Street Elevated	100	13	13½
North Chicago	100	190	200
Union Traction, com	100	15½	16
do. do. pref	100	58	60

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23⅛	23¼
do. do. do. pref	50	64	64¼
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	49	50

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Electric Boat, com	100	19	21
do do pref	100	45	50
Electric Lead Reduction	100	2½	2⅞
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	1¾	2
do do pref	100	4	5
General Carriage	100	⅞	1
General Electric	100	258½	258¾
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	250	251
General Electric	100	258½	258¾
Massachusetts Electric Companies, com	100	37	37¼
" " " pref	100	94	94¼
Westinghouse Electric & Mfg., com	50	70½	71½
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	161	161¼
National Carbon, com	100	20½	21
do do pref	100	84	85
PHILADELPHIA.			
Electric Company of America	50	6½	6⅝
Electric Storage Battery, com	100	68	69
do do do pref	100	85	86
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	5	5½
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	93	94
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
BOSTON.			
American Telephone & Telegraph Company	100	158	158¼
Erie Telegraph & Telephone Company	100	21	22
New England Telephone Company		132¼	132½
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co.	100	105	110
Commercial Cable Company	100	180	185
Franklin Telegraph Company	100	45	54
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	116	118
Mexican Telephone Company	100	2	2½
New York & New Jersey Telephone Company	100	168	170
Pacific & Atlantic Telegraph	25	78	85
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		90½	90⅝
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	116
Cumberland Telephone & Telegraph Co.	50	133¼	133½
Chesapeake & Potomac Telephone Company	100	60	65
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		75	76
Hudson River Telephone Company	100	105	110
Northwestern Telephone Company, guar	50	124	126
Providence (R. I.) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Nov. 4.

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1⅜	1½
Eddy Electric Manufacturing Company	25	8	8¼
Storey General Electric	10	12	13
Consolidated Car Heating	100	55	57
Standard Underground Cable	100	218	220
Pratt and Whitney, pref	100	90	95

STREET RAILWAY BONDS.

	Last Sale.	Int. Paid.
ALBANY.		
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅝@16⅝c.; Lake, 16¾@17c.; casting, 16½@16¾c.

Pittsburg capitalists have bought the El Paso, Tex., Traction Company for $621,000.

The State Board of Equalization of Illinois has decided to tax the capital stock of all corporations.

The regular quarterly dividend of 1½ per cent. on the stock of the West Chicago Street Railway Company will be paid November 15.

Some Boston people who pay a great deal of attention to the copper situation incline to the belief that it is only a question of time until the price of the metal is radically cut.

The electric railroad on the Eads Bridge across the Mississippi River at St. Louis has been sold to a syndicate representing interests in New York, Chicago, St. Louis and East St. Louis.

It is said that the management of the Chicago, Burlington & Quincy Railroad Company, has decided to equip a portion of the company's suburban lines with the third-rail electric system.

The Atlantic Telephone Company of New York City has asked the Supreme Court to compel the Commissioner of Lighting to give a permit to string wires through the Rapid Transit tunnel.

An official of the New England Electric Vehicle Company says: "There is no foundation for the report that the Armstrong Transfer Company is to take over the business of the New England Electric Vehicle Company."

Nearly 420,000 of the total of 570,000 shares of the Pittsburg Consolidated Traction Company were deposited Saturday under the terms of exchange offered by the Philadelphia Company, insuring the success of the project.

Twenty-five of the copper stocks showed in October an average decline from the highest of the year of $35, meaning a shrinkage of all of $150,000,000 in market value. To this total Amalgamated's decline from 150 to 83¼ contributed on its 1,550,000 shares a loss of $72,850,000.

The American District Telegraph Company, with a capital of $1,000,000, filed articles of incorporation with the New Jersey Secretary of State Saturday. The incorporators of record are Herbert D. Bennett and Gansey N. Johnson, of Columbus, O., and Keneth McLaen, of Jersey City.

It was officially announced Saturday that the Pittsburg and Lake Erie Railroad Company will begin at once the equipment of the entire system with automatic electric block signals. The Union Switch & Signal Company of Pittsburg has been awarded a contract for part of the work.

There is still the same steady tone to note in the market for copper, and prices are firmly maintained with cash Lake quoting 17, and Electrolytic 16⅝ to 16¾. There is no sign that there will be any change in market prices in the near future and holders refuse business below established rates. There is at present no unusual demand to report.

The Rochester and Eastern Railway Company has received authority from the New York Railroad Commissioners to operate its lines from Geneva to Canandaigua aad Rochester by the overhead electric trolley system. The Canastota and Morrisville electric road has been granted authority to construct its lines from Canastota to Morrisville.

In Western Florida Ohio parties have secured a franchise to build an electric railroad, which, with branches, will be 100 miles in length, reaching the towns of Tampa, St. Petersburg and Plant City; the scheme includes a street railroad 20 miles long in Tampa. John P. Martin, of Xenia, O., who is engaged in building an electric railroad in the latter State, is promoting the Florida enterprise.

It is reported that the New York Central is asking for estimates on the cost of equipping the Putnam division with electricity. If the new system of the Manhattan should be adopted, then a through service from the Battery to Yonkers might be established. President Newman is quoted on the subject as follows: "That is a matter which has been under consideration for some time, and it will probably be carried out if the change in motive power on the Manhattan lines proves successful.

The Electrograph Company of America was incorporated at Wilmington, Del., on Saturday last. The capital is $1,000,000 and the company will manufacture and sell appliances and instruments for the transmission by electricity of fac similes of writings, pictures, drawings, maps, and other designs. Its main office will be at Cleveland. The company organized on Saturday, electing these directors: W. E. Bemis, New York; E. H. Bourne, Cleveland; John F. Taylor, Chicago; F. B. Squire, Cleveland; Charles R. Huntley, Buffalo; Frank Martin, New York; Addison C. Thomas, Chicago; H. R. Palmer, Cleveland; C. M. Palmer, New York; W. H. K. Rose, Cleveland; Irving W. Durfree, Detroit.

A mortgage for $6,000,000 given by the Consolidated Telephone Company of Pennsylvania to the Equitable Trust Company, trustee, of Philadelphia, has been filed in the office of the Recorder of Deeds of Northampton County, Pa. The Consolidated Telephone Company, which was formerly the Schuylkill Valley Telephone & Telegraph Company of Reading, has consolidated the following corporations and lines: Lackawanna Telephone Company of Scranton; People's Telephone Company of Wilkes-Barre; Anthracite Telephone Company of Hazleton; Danielsville Telephone Company of Danielsville; Slate Belt Telephone Company of Slatington; Lehigh Telephone Company of Allentown, and the Interstate Telephone & English Company, operating lines in Lackawanna, Luzerne, Carbon, Lehigh, Northampton, Montgomery, Berks and other counties in Pennsylvania.

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EDITORIAL NOTES.

The Principles of Dynamo Construction.

Elsewhere in this issue will be found the first article of a series on "Principles of Dynamo Construction." These articles will be devoid of intricate mathematics, at least so far as the proper treatment of the subject will permit. The series was written with the object in view of helping the practical worker as well as serving as a guide to young electrical engineers, who have decided to make designing and the construction of electrical machinery their life work.

Judging from the number of complimentary letters we have received from practical men in all parts of the country referring to ELECTRICITY's Educational Series, which ran in this paper some months ago, we feel convinced that there is a demand for a series such as we are now starting to run, and that it will meet with the approval of the majority of our readers.

* * *

Steps Taken Looking to the Organization of an Electrochemical Society.

The movement that was started a couple of weeks ago in Philadelphia looking to the organization of a national electrochemical society, and to which we referred in a short paragraph in our issue of November 6, would seem an excellent one.

Those present at the meeting in Philadelphia included representatives from New York City, from the Cornell, Lehigh, and Johns Hopkins Universities, from the American Chemical Society, the American Institute of Electrical Engineers, the Franklin Institute, etc.

Prof. J. W. Richards, vice-president of the American Chemical Society, acted as chairman, and Carl Hering, past president of the American Institute of Electrical Engineers, as secretary. All those present were heartily in favor of the measure, the only doubt expressed was whether a sufficient number of members could be obtained to make such a society a success. A committee was appointed with Dr. Chas. A. Doremus, of the College of the City of New York, as chairman, to canvass for members, and if seventy-five or over pledge themselves to join, the society will be formed. In that case, certain committees which were appointed will arrange for holding a formal meeting, at which the society will be founded, and papers read and discussed. Any one desiring to become a member is asked to communicate with Dr. Doremus at the above address.

It was furthermore decided to be the expression of those present that the name of the organization should be the American Electrochemical Society, that the dues should not exceed $5 per year, and that at first only a few meetings of a few days each should be held per year, and that they be held in different cities, as the society is to be a national one.

The fact that papers on the subject of electrochemistry are now scattered over a half dozen or more existing national societies, was thought to be in itself a very good reason for bringing them altogether into one, where they could then be properly discussed, which is not now the case. Attention was also called to the fact that the annual electrochemical products of this country already amounted to nearly $100,000,000, which is far greater than all the other countries combined. Germany, which comes next, with $14,000,000 has a flourishing electrochemical society with about 40 members in the United States. The bringing together of those engaged in the scientific and in the industrial phases of electrochemistry was thought to be of great value.

* * *

An Earnest Plea for Street Railways.

In many of the large cities before the recent elections there was considerable agitation for larger taxation for street railways, many "experts" in municipal government considering the theme a delightful one to harp on for political success. In view of this it is interesting to read in the November "Forum" an article that is a good argument for the railway companies. The writer is extremely opposed to special taxation, and takes the ground that rather than special taxation, street railways should be exempted from all taxation. The claim is that street railway franchises are granted to a few on the theory that those operating under them perform a service to the many, and while they should be hedged about with such safeguards as a sound policy suggests for the benefit of the people from whom the franchises are derived, no taxes should be imposed beyond those which all property owners must bear, with enough in addition to compensate the city for the increased wear and tear of the streets.

The rates of fare, it is urged, should be fixed at the lowest limits consistent with a fair return on the actual capital invested. There should be harmony of action as between the people granting the franchise and the people exercising it. To bring about the proper relations between them some legislation is necessary, and a great deal must be done in the way of educating public opinion. The mutual advantage should be recognized and appreciated on both sides. As the writer indicates, the advantages to be derived from a complete system of street railways, extending in all directions through the suburbs of a large city and giving low rates of fare, are manifold. The benefit to the city itself by the opening up of large tracts of unimproved land, with the subsequent enhancement in taxable value, will be plainly shown in the tax-roll; and this of itself is considered ample compensation for the grant of the right to lay rails in the streets. The point is made that the improvement in the social conditions of the city through the distribution of the population over larger areas, and the consequent diminution of the evils of overcrowding in the tenement house districts, are not easy to estimate in terms of dollars and cents; but they result in a very solid advantage to the health and morals of the community. Any improvement in this direction tends to reduce the expenditure of the city for sanitary, charitable, and police purposes, and this reduction in outgo is also a form of compensation.

Summed up it is the judgment of the writer that if municipalities and municipal reformers will treat the street railways as institutions to be fostered, exempt them from all unnecessary burdens, insist on low rates of fare, and allow those investing their money a fair return on the money actually invested, all the participants in the enterprise will benefit far more than will be the case when efforts are continually made to hamper their development by the imposition of extra burdens.

* * *

Return of the Rapid Transit Inspection Committee.

The party consisting of August Belmont and several engineers that went to Europe a short time ago to inspect the underground roads abroad with a view to being in a position to give the citizens of this city the most up-to-date system of underground rapid transit, returned last week on the steamer Oceanic.

The members of the party were rather reticent regarding the information gathered, but Mr. Belmont spoke as follows:

"We made a full inspection of the underground systems in London and were accorded every possible facility and courtesy. We found a great deal which was both useful and valuable and very interesting. Neither the requirements nor the character of the construction and equipment are parallel to ours, so that no direct comparison could possibly be made. Nevertheless there was much that was useful to each one of our party in his special department. We have made an arrangement for a full interchange of detail of operation, construction and experiments, and an active correspondence will be immediately inaugurated between ourselves and the London companies and maintained for the purpose of mutual benefit.

"From London we visited Paris and made a thorough inspection there, in like manner receiving the most courteous attention, and were afforded the fullest possible information. We have also arranged a mutual interchange of ideas and results with the Paris Underground. The Paris system is, in some respects, somewhat parallel to the requirements of what our local service will be, and we found much that will be useful, as we did in London.

"I do not think it would be courteous for us, after our reception and treatment abroad, to make comparisons. I will say, however, that the people in New York may expect the best underground road in existence, so far as we can at present judge."

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

The electric broad gauge railroad experiments between Berlin and Zossen have resulted in the train attaining a speed of 93 miles an hour.

◆

A cable dispatch says an American firm has received a franchise to construct an electric street line in St. Petersburg, Russia, which involves building an enormous bridge over the river Neva. The whole cost of the enterprise is estimated at $50,000,000, and has received the sanction of the Minister of Finance of Russia.

◆

The Minister of Commerce of France is arranging to establish a technical school in the United States where French students may study American methods of production. Formerly students were sent from France to England and Germany.

◆

Henry Hart, for many years president of the Third Avenue Railroad of New York, died last week. He left a fortune of $5,000,000.

◆

W. E. Baker, the electrical engineer who has charge of the electrical equipment of the Manhattan Elevated Railroad in this city, said last week that in less than two months the stations and station platforms of the Second Avenue branch of the road will be illuminated by electricity. Each station will have fifty lights of 12 candle power each, and the lights will be kept burning from sundown until dawn.

◆

Martin C. Burt, inventor of the Burt dynamo and president of a Chicago electric light, fuel and power company, has recently been in Washington, D. C., for the purpose of making researches in connection with his invention. He also expects to apply for patents for several improvements to the Burt dynamo, now in course of construction.

◆

Carriages lighted with electricity promise to be used in the near future. The lights will illuminate the interior of the vehicles, in addition to the ordinary carriage lights at either side of the coachman's box. Three small batteries are placed under the coachman's seat. At the side of the box is a small switchboard by which the coachman can illuminate the interior of the carriage at will. In the center of the top of the vehicle is a small electric bulb which casts a light of one candle power. The presence of the wires which connect the switchboard and the bulb is hidden by the black enamel. The purpose of the innovation is to furnish light when the occupants of a carriage are entering or leaving, and it promises to be a much appreciated improvement.

◆

Some time ago an American obtained the right to place an electric plant in India. The waters of a fall were utilized at Cauvery Falls and the electric power was carried to the mines of Mysore, 98 miles distant. Since then English enterprise has been aroused to place other plants in other parts of that country.

◆

The annual banquet of the members of the testing department of the General Electric Company of Schenectady was held at the Stanwix in Albany on Saturday evening last. About 200 members were present, including among them men from England, Russia, Germany, Japan, France, Brazil, Canada, Italy, Austria, Ireland, Australia, United States of Colombia and Mexico. In addition to these about two-thirds of the States in the Union were represented. General Manager E. E. Emmons of the General Electric Company, and Foreman E. B. Raymond gave a brief history of the company since its establishment at Schenectady. Other addresses were made by C. P. Steinmetz, J. C. Schermerhorn, G. W. Redfield and F. Jones.

◆

The Zürich section of the German Electrochemical Society recently discussed an instructive paper by a Mr. Schmidt, in which the author pointed out the advantages gained from the use of electrical power for making water gas. In the present method usually adopted in Switzerland, according to the London "Electrical Engineer," water steam is conducted over glowing coal, with the result that CO and hydrogen are formed. Much heat is, however, absorbed in the process, as in the combustion of C to CO only about half the number of calories which are required for the decomposition of the water are set free. It, therefore, requires that the furnace shall be supplied from time to time with fresh heat, which is a costly operation. If 42 cubic meters of water gas be produced from 12 kg. of pure carbon—about 13.5 kg. of coke—there are missing 28,970 calories, for which about 8.8 more kilograms of coke are required. If, instead of the latter, electric heating be used—an efficiency of 80 per cent. being assumed—about 42.5 kilowatt-hours are required. Assuming the price of coke to be one cent per kilogram the process of electric heating is economical, if the electric power cost not more than 0.21 cent per kilowatt-hour. The author considers that electric power can be furnished at this price at many places in Switzerland, especially at certain hours of small load. Although Switzerland must import all its coal, the country is rich in water power.

◆

Thomas A. Edison pays almost daily visits to the factory at Glen Ridge, N. J., which is being converted into a manufactory for his new storage batteries. Within a short time the factory will be ready for use, and soon thereafter the new battery will be placed upon the market. The famous inventor says it has reached a state where there can be absolutely no chance of its being anything but what he expects it to be. In discussing the battery he said: "It is an assured success and meets my greatest expectations. I now have something which will greatly simplify the operation of the horseless carriage You can run 60 or 70 miles at a rate of 20 miles an hour in an electric vehicle fitted with the storage battery. It will be so simple that women and children can operate it. There will be no bad smells, no explosions, no complicated machinery rendering a visit to a repair shop a matter of every day or two. Automobiles will be the great vehicle of the future. They will eventually be so cheap that persons of moderate means can afford them and find the investment more satisfactory than that of a horse and carriage. I think the price of automobiles will be $500 one of these days, and that not so very long away. Their great weight now is a drawback. My storage batteries will be a step forward, and will be followed rapidly by others."

◆

PLANS are about completed in the Brooklyn, N. Y., Navy Yard for proposed Dry Dock No. 4. As soon as they are finished they will be forwarded to Washington, D. C., for approval. The dock is to have a pumping plant situated in the bottom of the caisson operated by electricity. No such pump has been used before in this country. The electrical power station is to be situated some distance from the dock. Pumping plants of this character are commonly used in connection with dry docks in Europe. It is contended by officials at the yard that the Government will be saved $70,000 by its use.

◆

MONTGOMERY H. JOHNSON, a Utica, N. Y., electrician, has secured a patent on a switchboard and fuse box perfected by him. The invention relates to a device for distributing electrical energy from large conductors to smaller ones and properly protecting and maintaining the mechanism employed for this purpose. The device, it is claimed, comprises means for doing this and is so arranged as to be easily installed under all the varying conditions required in such distribution, and is absolutely safe as well as convenient to the operator in replacing and readjusting fuses and opening and closing connections therewith.

◆

NEWS received from Indianapolis, Ind., states that the New Telephone Company in that city has determined to open a school of elocution for the benefit of both the "hello girls" and the public. It is believed that many of the mistakes which occur in the exchange and much of the inconvenience caused to patrons are the direct result of the want of clear enunciation on the part of the operators. One of the best elocutionists in the city has been employed, and will give regular lessons in voice culture. The school will be opened in the company's building, and every employe who is any way connected with the telephone service as an operator will be required to devote a certain number of office hours each day to improvement of her voice.

◆

THE Japanese Government has adopted a new plan to provide capital for the extension of the railroads and telegraphs, which are now yielding a profit of 7 per cent. It purposes selling immediately 16,000,000 yen in bonds to the postal savings banks, appropriating the surplus revenue for the railroads and telegraphs and providing for gradual sales of bonds in the domestic market. Foreign money will not be sought, except on favorable terms, as the steady influx of gold resulting from prosperous trade, and a fine harvest also, renders easy domestic financial operations.

◆

THE wave motion of the sea is utilized to run an electric-lighted buoy at the mouth of the river Elbe in the North Sea. The least motion of the water is sufficient to generate the electric current, which when not needed passes to storage batteries. The success in this case and in the generating electricity by means of floats off the shore of Los Angeles, Cal., is encouraging to the belief that the power of the waves will later be made valuable to coast towns.

◆

Sad Accidental Death of James W. Godfrey.

James W. Godfrey, manager of the Habirshaw Insulated Wire Company, 15 Cortlandt street, was thrown from his buggy last Saturday night at St. Nicholas place and 157th street, and died from his injuries in the J. Hood Wright Hospital two hours later. Mr. George Morgan, a broker, who was with him, was also thrown out, but his injuries are slight. Mr. Godfrey had been driving on the Speedway all the evening accompanied by Mr. Morgan. At 6 o'clock the two men drove to the Riders and Drivers' Club at the upper end of the Speedway and had supper. They were returning home when the accident occurred.

JAMES W. GODFREY.

At St. Nicholas place Mr. Godfrey turned his horse into the side street to leave the Speedway. St. Nicholas place is dark there, narrow and shaded with trees. Suddenly the horse shied and began to rear. Mr. Godfrey could not control the animal, which plunged to one side toward a pile of brick and dirt. The runabout was overturned and Mr. Godfrey fell beneath it. His head struck a brick and he became unconscious. The horse started forward, dragging the unconscious man. When the level ground was reached the vehicle passed over Mr. Godfrey and left him lying in the road.

Mr. Morgan, who had received only a few scratches, ran to the assistance of his friend and found that he was still alive. He summoned an ambulance, and the surgeon found that Mr. Godfrey's skull was fractured.

Mr. Godfrey lived at No. 1893 Seventh avenue. He left a widow and two daughters—Miss Pearl Godfrey and Mrs. A. Archibald.

Among electricians—the country over—"Jim" Godfrey, as his army of friends called him, was extremely popular. He seldom missed an Electric Light Association Convention, was always chock-full of good-fellowship and would turn many a corner to plan a practical joke—as the newspaper men all know. No one will miss Mr. Godfrey's good qualities more than Dr. Habirshaw, whose great grief will be sincerely shared by the electrical fraternity.

PRINCIPLES OF DYNAMO CONSTRUCTION.—I.

(Written for ELECTRICITY.)

In the following a few introductory principles are set forth, each and all of which are essential to the design and construction of dynamos and motors.

A dynamo is a generator of electricity, not in the sense that from the machine itself can be produced electric phenomena, but by applying mechanical power to such a device a transformation is effected of such power into electricity. Were the dynamo a perfect machine in which no losses occurred of any description, we would obtain a quantity of electrical energy exactly equal to the power or kinetic energy applied. But when such a transformation takes place losses are inevitable. Constant subtractions from the original source of power occur all along its path.

These differences do not represent cases of the entire annihilation of energy; they in themselves are simply streaming and non-uniform distribution of the magnetic force according to the shape of the magnetized material.

A line of force, by its definition, can represent a certain quantity of mechanical energy.

A uniform magnetic field, that is to say, a field each square centimeter of which possesses the same number of lines of force, will exert a uniform pull at every point.

In the design of electrical machinery a field of the above description is, in a majority of cases, absolutely necessary.

The shape of the iron has everything to do with a field, as regards its uniformity or distortion.

A distorted field generally causes excessive leakage, which, from the standpoint of economic design, is wasteful and injurious.

The dynamo has for its primary object the production of electromotive force.

Electromotive force can only be generated by a variation of the lines of force with respect to a conductor.

Either a conductor is moved so as to cut, thread or inclose lines of force; or the lines of force are changed in position so as to cut the conductor.

In either case lines of force change their position with respect to the conductor—or the converse.

Under these conditions EMF. is always generated.

EMF. depends upon an additional factor for its production. The conductor may be at rest, while the lines of force may be varying simply because the current is changing. The EMF. in a transformer is generated in the secondary coil because the varying alternating current in the primary is causing a corresponding change magnetically in the core of the secondary and hence producing EMF.

LINES OF FORCE.

Every line of magnetic force is a closed loop. A definite relationship exists between the current flowing in a coil of wire and the number of lines of force it is capable of producing.

Whenever a conducting circuit is linked by lines of force, an electromotive force is developed in strict proportion to the number of lines of force it incloses.

The magnetic effect in a coil of wire acts along certain lines, axes, or paths, thus producing for a limited area a concrete effect.

As a means of understanding and measuring this action quantitatively, a standard, or absolute line of force, was adopted.

A unit line of force is one of such strength that a unit pole placed on it will be urged along with the force of one dyne.

This line of force possesses as real a value as a unit of current or electromotive force, representing the integral effect over a certain area.

All standards used in science are taken from the absolute or centimeter-gram-second system; and the intensity of a magnetic field is measured by the number of lines of force per square centimeter.

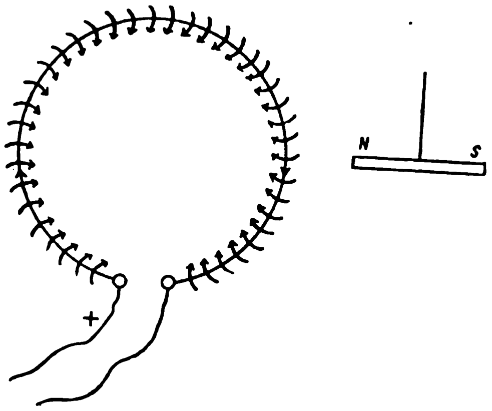

FIG. 1.

Oersted enunciated a law regarding a coil of wire carrying a current as follows:

A loop through which a current is circulating will act upon a magnetic needle just as if the loop were an infinitely thin magnet, having the same bounding line, and whose magnetic moment is equal to the current. (Fig. 1.)

If the current circulates through a coil of wire a succession of magnetic shells are produced, each acting in combination with the next to intensify the general magnetic effect. (Fig. 2.)

By the introduction of a bar of iron into this coil the co-operative effect of the loops is enormously increased. (Fig. 3.)

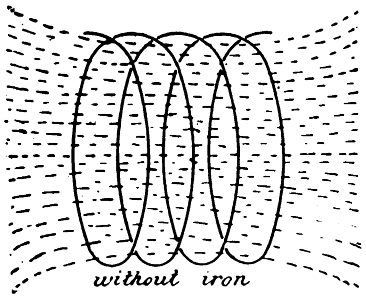

FIG. 2.

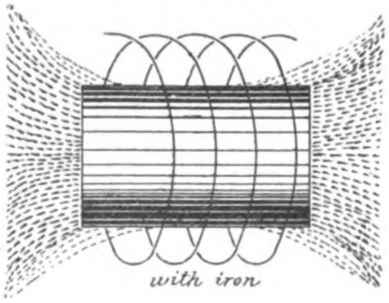

FIG. 3.

It can be shown by experiment that the increase is in the actual number of lines of force. The iron has caused a multiplying effect which disappears upon its removal.

THE POLARIZATION OF IRON.

Many theories have been proposed to account for the remarkable increase in the number of lines of force in a coil when iron is introduced.

That particular and most acceptable theory of all, which has been supported by the experiments of Joule, is the polarization theory.

Faraday and others have produced poles in every substance; so that it seems as though the molecules of all bodies possess in some degree this particular quality.

The realms of theory are necessarily of a shadowy nature, and it is always best to accept that particular hypothesis which is best substantiated by practical experiments. Therefore the opinion of the many eminent scientists regarding the strongly magnetic condition of the molecules of iron is best to us because the most plausible; though why so strongly developed in the Ferric group alone it is impossible to explain.

THE THEORY.

Each molecule of iron is supposed to be an infinitesimal magnet. When a mass of iron is in its normal condition, exhibiting no magnetic effect, it is because the molecules have no systematic arrangement; they are irregularly arranged, and due to this perfect irregularity and absence of grouping there is a complete annulment of any magnetic effect.

By taking a mass of iron and subjecting it to a magnetic force, we arrange the molecules in systematic order by turning them on their axes.

Being now regularly arranged, the molecules independently give forth their latent magnetic force and create a new field.

Joule found by experiments of a most delicate nature that bars obeyed a law, when under magnetic influence, such that "the elongation is proportional to the square of the magnetic intensity." By direct measurement the bars increased by $\frac{1}{72,000}$ of their length; when the force was removed the molecules immediately formed closed magnetic circuits amongst themselves, thus removing—according to the softness of the iron—every trace of the previous magnetization.

The softer the metal the greater Joule found the elongation to be. Thus, in total, we see the grounds on which to support this theory of polarized molecules; the continued polarization is supposed to be due to an electric current flowing unceasingly around the molecule. It cannot stop because the molecule offers no ohmic resistance; the resistance is considered as only being experienced when the current passes from molecule to molecule.

Hence the theory is, from a logical standpoint, quite supportable as regards the molecular change giving rise to elongation, also as a reason, quite interesting in itself, for the permanent polarization of the molecules of the iron. Perhaps the inter-molecular spaces of a metal has more to do with its specific resistance as a conductor than its other physical qualities. The stratum of ether surrounding an iron molecule is probably in a most abnormal condition as compared to that of other substances.

Whereas iron is the best known medium for the development of magnetic lines of force, silver and copper are conductors unexcelled for the passage of an electric current, though both may, when peculiar conditions are imposed, become almost non-conductors—the one for magnetic force, the other for electricity. (Fig. 4.)

If in a constant field different grades of iron be respectively inserted the resulting magnetic fields will be different for each sample of iron.

The multiplying effect of the iron when exposed to different field strengths is measured by the ratio of

$$\text{Permeability} = \frac{\text{Strength of Field with Iron}}{\text{Strength of Field without Iron}},$$

or more concisely expressed

$$\mu = B \div H$$

where μ = permeability,

B = strength of magnetic field with iron,

H = strength of magnetic field without iron.

It is necessary in order to intelligently use these quantities for the purpose of design to understand them apart from their purely physical meaning.

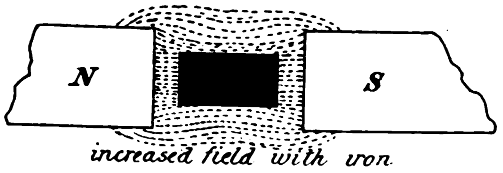

FIG. 4.

Formulæ as a rule are deduced from ideal conditions; and in this particular case, although we are confronted with a similar basis for our equations, they will present a very simple aspect if closely followed.

Imagine a magnetic pole of any strength at all. Emanating and spreading from this pole in all directions are lines of force. They spread equally, so that any area of a sphere surrounding this pole as a center will contain the same number of lines of force as any other equal area.

If this pole be supposed to be the center of a sphere of any size whatsoever, whose radius we call r, then the surface of the sphere is $12.57 \times r \times r = 4 \pi r^2$ by the laws of geometry.

If, as a second supposition, the strength of this pole be called m, then the magnetic force at a distance r from this pole equals $m \div r \times r$ = magnetic force at a distance r on the surface of this imaginary sphere.

The inquiring mind immediately asks for an explanation of the expression $m \div r \times r$. This is given as follows:

The magnetic force with which the pole m (Fig. 5) would act upon a unit pole at a distance r is equal to the following:

$$\text{Force} = \frac{\text{The product of their strengths}}{\text{Square of the distance between them}};$$

but by our supposition one pole is of unit value, therefore

$$\text{Force} = m \times 1 \div r \times r = m \div r \times r.$$

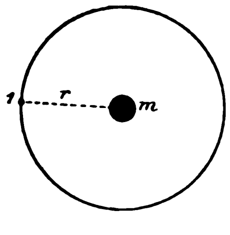

FIG. 5.

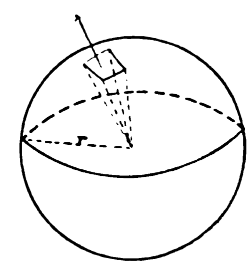

FIG. 6.

If a unit pole be placed in the center of a sphere of 1 centimeter radius, each square centimeter on the surface of the sphere will contain one line of force.

This is the scientific and naturally the correct way of regarding the line of force employed in dynamo calculations.

The three quantities represented by B, H and μ are all important in dynamo design and construction as they represent all that is of practical value in the magnetic field.

Some tables are given below showing the values of B, μ and H for square inch and square centimeter areas:

SQUARE INCH UNITS.

Wrought Iron.			Cast Iron.		
B	μ	H	B	μ	H
30,000	4,650	6.5	25,000	763	32.7
40,000	3,877	10.3	30,000	756	39.7
50,000	3,031	16.5	40,000	258	155.
60,000	2,159	27.8	50.000	114	439.
70,000	1,921	36.4	60,000	74	807.
80.000	1,409	56.8	70,000	40	1480.
90,000	907	99.2	....	..	....
100,000	408	245.	....	..	....
110,000	166	664.	....	..	....
120.000	76	1581.	....	..	....
130,000	35	3714.	....	..	....
140,000	27	5185.	....	..	....

SQUARE CENTIMETER UNITS.

Wrought Iron.			Cast Iron.		
B	μ	H	B	μ	H
5,000	3.000	1.66	4,000	800	5.
9,000	2,250	4.	5,000	500	10.
10,000	2,000	5.	6,000	279	21.5
11,000	1,692	6.5	7,000	133	42.
12,000	1,412	8.5	8,000	100	80.
13,000	1,083	12.	9,000	71	127.
14,000	823	17.	10,000	53	188.
15,000	526	28.5	11,000	37	292.
16,000	320	50.	....	..	....
17,000	161	105.	....	..	....
18,000	90	200.	....	..	....
19,000	54	350.	....	..	....
20,000	30	666.	....	..	....

Ampere considered the magnetic effect of a current in a coil of wire, not as Oersted did, but differentially. The absolute unit of current which is obtained by sending a current into an arc of wire is that which will effect a unit magnetic pole with the force of one dyne, if the wire be of one cm. radius and one cm. length.

Any wire containing a current is surrounded by magnetic whirls. The greater the length of the wire the greater will be the collective effect the of whirls.

By bending the wire into a loop, the issuing magnetic force is centered in the middle of the coil.

It is evident that the greater the diameter of such a coil the greater will be the number of lines of force it will produce, while a corresponding increase in potential will be necessary to send the same current over the greater length of wire.

The effect at the center of an ampere-turn, no matter of what diameter, is always the same. Place a piece of iron in such a series of unequally sized loops, however, and the magnetic fields resulting will possess unequal numbers of lines of force.

If the same current passes through all the coils, the number of lines of force produced by each respectively will be in proportion to their circumferential lengths.

In other words, if the magnetic effect of a length of wire of 1 inch be called 10 when one ampere passes, the magnetic effect of 2 inches with the same current would be doubled or 20.

If the magnetic effect of a wire in which a known current passes is proportional to its length, then, instead of considering the length we need only consider the number of turns which surround an iron core and thus measure the magnetic force.

MAGNETO-MOTIVE FORCE.

The similarity in many respects of the physical relation existing between the lines of force and other important quantities in a magnetic circuit is such that an expression like Ohm's law has been used as a means of representing this relationship.

Lines of Force = Magneto-Motive Force ÷ Reluctance,

$$\text{or } B = \frac{\text{M. M. F.}}{\text{R}}$$

Generally speaking, by magneto motive force is meant that force by whose immediate means the lines of force spring into existence.

The symbolic representation of all the quantities involved in the production of lines of force is of a simple nature.

$$\left.\begin{array}{r} n\,c = \text{ampere turns,} \\ \mu = \text{permeability,} \\ q = \text{cross section,} \\ l = \text{length,} \\ B = \text{lines of force,} \end{array}\right\} B = \frac{4\,\pi\,n\,c\,\mu\,q}{10\,l}$$

It is of course to be understood that the quantity μ, though of a changing value for magnetic substances, is of a fixed value for air.

The standard of comparison being air, the value of μ in such calculations is 1.

The above formula rearranged would give

$$4 \times \pi \div 10 = 1.257,$$

therefore $4 \times \pi \times N \times C \div 10 = 1.257 \times N \times C$, which is called the magneto-motive force.

Also $\mu \times q \div l$ may be written below the denominator of the original formula as follows:

$$\frac{\;\dfrac{1.257 \times N \times C}{l}\;}{\mu \times q}$$

in which case $l \div \mu \times q$ is called the reluctance. In using the formula only the permeability and the geometrical dimensions of the iron must be determined to find ampere turns.

The reluctance of any magnetic body is determined by its geometrical proportions and its permeability.

The reluctance decreases as the permeability increases, or as the cross section increases, it increases as the length increases.

The reluctance of air is enormous as compared to iron. The lines of force resulting from the application of ampere turns to air and iron are about in the proportion of 1 : 1,000 for equal volumes at low inductions.

Spec. Induct.	N. C. for Iron.	Air.	Ratio.
16000	45	5120	113
15000	26	4600	177
14000	16	4480	280
13000	13	4160	347
12000	8	3890	480
11000	6	3520	586
10000	5	3200	640
9000	4	2880	720

Quite a celebrated writer and authority on this subject remarks: "The continuous flow of magnetism through a piece of iron does not produce heat and does not absorb energy; and it is on account of this property of the magnetic circuit that some scientists have suggested to discard the term 'magnetic resistance.' As a result of this and other formidable criticisms by able authorities, the term 'reluctance' as given above has greatly displaced the other more doubtful expression."

In the formula

$$\text{B} = \frac{\text{M. M. F.}}{\text{R}}$$

we have by transposition

$$\text{R} = \frac{\text{M. M. F.}}{\text{B}}$$

By the above formula a comparative table can be drawn up, showing the reluctance of the iron for different permeabilities, in the C. G. S. system and the English measure.

The permeability is a coefficient of magnetic conductivity, changeable by heat or cold; and assumes for each sample of wire or steel a different initial value.

Magnetic reluctance in C. G. S. units, magneto-motive force, total magnetic flux.		Magnetic reluctance in inch units, ampere turns, the total magnetic flux. Slab—one inch thick.	
Reluctance.	Permeance.	Reluctance.	Permeance.
0 2461	4.068	0.0771	12.968
0.3404	2.938	0.1066	9.377
0 4084	2 449	0.1280	7.815
0 4628	2.161	0.1450	6 897
0 5084	1.967	0.1593	6.278
0.5470	1.825	0.1717	5 825
0 6140	1.629	0.1924	5.198
0 6681	1.497	0 2093	4.777
0.7144	1.400	0.2238	4.571
0 7550	1.324	0.2385	4.238
0.7903	1.265	0.2476	4.039
0.8220	1.217	0.2575	3.883
0 8511	1.202	0.2667	3.750
1.0500	0.952	0.3290	3 040
1.1710	0.854	0 3669	2.726
1.2624	0.792	0.3955	2 528
1.3250	0.755	0.4151	2.409

The coercive force of a magnetizable metal determines its ability to hold its residual magnetism after the magnetizing force has been removed.

The retentivity of wrought-iron is greater than steel while its coercive force is less. The magnetic induction in a sample of steel and wrought iron will be greater in the wrought-iron when the M. M. F. is removed, due to its retentivity being greater; but if both samples be then jarred and shaken, the superior coercive force of the steel will enable it to retain a higher magnetic induction than the wrought-iron. The permeability of iron in general is very high. Wrought-iron of the soft annealed kind has the greatest permeability of any known metal. Following this comes the mild steel product, which affects a compromise between cast-iron and wrought-iron, then following in succession come the alloys.

If a sample of steel be produced containing a very small proportion of carbon a commercial article superior to wrought-iron would result.

Cast-iron possesses magnetic proportions that are but little more than one-half those of wrought-iron.

Its permeability is of a more changeable nature than in either steel or wrought-iron, and the least impurities makes its magnetic value a question of great uncertainty.

Different grades of iron are valuable in proportion to their permeabilities.

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THE ACKER PROCESS FOR THE ELECTROLYTIC PRODUCTION OF ALKALIES AND CHLORINE.*

BY JOHN B. C. KERSHAW, F. I. C.

The Acker process and cell for the production of caustic alkalies and chlorine by the electrolysis of fused chlorides are protected by a series of American and foreign patents, the more important of which were applied for and granted in the year 1899. As this process is now in actual operation at Niagara Falls upon an industrial scale, the following description of it will doubtless be of interest. At the outset one is met by the difficulty that a large number of patents have been taken out in the name of Acker, protecting various forms of cell and apparatus, and the exact design of the cell now being used at Niagara may be a modification of one, or combination of many, of the designs described in these numerous patents. The writer has applied for information directly to the Acker Process Company at Niagara Falls, but, as usual in such cases, the company declines to be very explicit concerning the details of the plant at Niagara. The following description of the cell, although based on the 1899 patents, must, therefore, be taken as applicable to the Niagara cell, only in its main features, and it is quite possible that the cell actually employed differs in details of construction from that described below.

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*From the "Electrician," London.

The principle of the Acker process and cell is the use of fused salt as the electrolyte with molten lead as cathode material. This combination is not novel, having been patented by Vautin in England in 1893, and again by Hulin, with modifications, in France, in 1894. Vautin's cell was tried upon an experimental scale at Bolton, in Lancashire, about 1894 without success; while that of Hulin received trial at Modane and at Gavet-Clavaux in the years 1897-99 upon a larger scale of operations. The works at Gavet-Clavaux, where 2,500 hp. had been developed for industrial use, were shut down early in 1900, owing to financial and other difficulties. These facts prove that the electrolysis of fused salt with molten lead as cathode, is not one of the simplest problems in electro-chemical industry; and that others have failed to attain success along the path which Acker has selected as most promising.

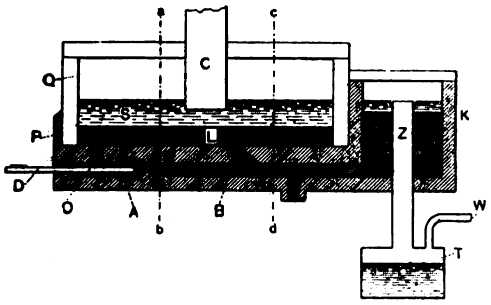

FIG. 1.

The Acker cell is shown in diagrammatic longitudinal section in Fig. 1. The bottom of the cell P is trough shaped and is constructed of cast iron. It serves as electrical connection between the main conductor and the mass of fused lead resting upon it, marked L in the figure. The upper portion of the cell Q is constructed of any refractory basic material not attacked by chlorine gas or fused salt, and fits closely into the lower cast-iron trough. A central opening in this upper portion of the cell admits the thick carbon rod C, which dips into the fused salt S and acts as anode. Up to this point the Acker cell does not differ materially from that of other inventors, but novel features are introduced in the plan for removing and decomposing the lead-sodium alloy, and for returning the purified lead to the cell. Figs. 2 and 3, which represent diagrammatic cross-sections of the cell base along the lines *ab*, *cd*, will assist in understanding this feature of the cell. The cast-iron trough which forms the base of the cell is not solid, a hollow rib runs centrally along its whole length and two other channels running parallel to this central one extend for one-half of the length of the cell. Figs. 2 and 3 show the cross sections of these channels in the base of the cell. All of these channels communicate with a side vessel, also of cast-iron—marked K in Fig. 1- and by the openings at O and B in the base of the cell the three channels are placed in connection with the lead sodium alloy acting as cathode. The pipe E ending in the egg-shaped enlargement of the central channel at the point marked A in Fig. 1 supplies steam under pressure to the apparatus, and the suction thus produced at O draws the molten lead-sodium alloy from the cell into the closed chamber K. Here the steam and sodium react to form $NaOH$ and H which rise to the surface of the molten lead, and pass down the central pipe Z into the collecting vessel T. The purified molten lead collects in the lower part of K and continually flows back by the side channels and openings B into the bottom of the decomposing cell. The injection of steam at A thus effects three most important results. It produces, first of all, constant circulation of the molten cathode material; it removes the sodium from the lead-sodium alloy; and it supplies a certain amount of the heat required to maintain the lead in the molten state. The reaction between the sodium and steam, with formation of sodium hydrate and hydrogen gas, also produces a disengagement of heat which is absorbed by the lead in K. The hydrogen gas passing away from T by the pipe W can also be utilized for maintaining the heat of the cell. One of the 1899 patents describes a method for burning this in a chamber, to heat and fuse the salt fed into the decomposing cell. The amount of steam blown into the cell at A can also be regulated so that solid caustic is obtained without any boiling down operation. Fig. 4 shows a diagrammatic section of another form of the Acker cell, differing from the first only in the points at which the steam is injected into the cell, and the sodium hydrate and hydrogen are removed from the decomposing chamber K. The lettering is the same in both diagrams.

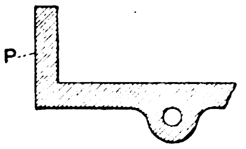

FIG. 2.

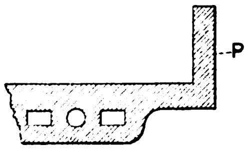

FIG. 3.

The channeled bottom of the Acker cell with its steam injector forcing the lead sodium alloy into the adjoining decomposing vessel, is certainly an ingenious attempt to overcome the special difficulties attending the circulation and purification of the molten lead cathode. It marks a distinct advance upon the methods adopted for this purpose in the earlier patents granted to Vautin, Hulin, and others for the same type of cell. Difficulties, no doubt, may arise at first in connection with the supply of steam to the injector. A writer in the "Zeitshrift für Elektrochemie" has recently criticized this feature of the cell, and has asserted that it will not be found possible to maintain the difference in mercury level of K and L required for rapid circulation of the molten lead, unless an excess of steam is used beyond that necessary to produce solid caustic soda. As opposed to this criticism there is the fact that Acker, in a letter to the writer, dated May 16, 1901, states that anhydrous caustic soda (79 per cent. Liverpool test) is produced without any evaporation. The suction and pressure effect will depend upon the care used in designing and casting the aspirator neck at A in the cell base, and in regulating the size and the position of the steam supply pipe D. When experiment has proved the most favorable form and dimensions for these, it is possible that with high-pressure steam the difficulty spoken of by the German critic disappears. A further disadvantage urged against this type of cell is that the reactions occurring in the chamber K between the sodium and steam, will keep the mass in a turbulent state, and that either molten lead will pass with the sodium hydrate into the vessel T, or sodium hydrate will be carried by the returning lead into the cell. This is a difficulty which perhaps is surmounted by increasing the lateral dimensions of the vessel K relative to the cell proper, and in reducing the height of the molten mass contained within it. As regards this point it must be remembered that the figures in this article are not drawn to scale, and are merely diagrams of the cell construction.

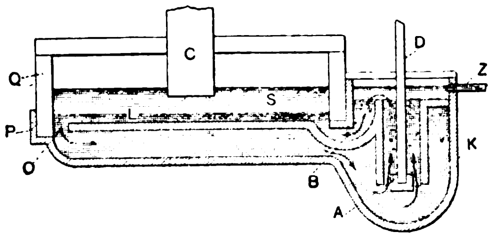

FIG. 4.

No details are given concerning the method of constructing the upper portion of the cell, and one is left in ignorance as to how far it has been possible to render the carbon anode and the cell walls proof against the well authenticated destructive action of hot chlorine gas and fused salt. It was partly owing to this difficulty that the early laboratory trials with the Vautin cell in England were suspended; the action of the fused electrolyte at the point where the salt and chlorine met destroyed every material used for construction of the cell walls. The customary plan with fused electrolytes of this nature is to allow a solid crust of the material to form on the inner walls of the decomposing cell, but no provision for this appears to have been made in the design of the Acker cell.

The writer has been unable to obtain from the inventor any figures for the yield of caustic soda and chlorine from the cell per kilowatt-hour; and no comparison can, therefore, be made between the electrical efficiency of the cell and process, and that of the Hulin or other forms of electrolytic alkali cell. At some future date possibly the necessary figures will be forthcoming.

The company owning the Acker patents for the United States was registered in 1899 with a capital of $5,000,000. The erection of the works at Niagara was commenced at once, and early in 1901 the first unit of the plant was started.

An unofficial statement announces that 2,400 kw. is already utilized in the manufacture, but this statement must be received cum grano salis. If the plant operates successfully the capacity indicated by these figures will no doubt be reached in time. At the present moment, with the history of the Richardson, Holland and Hulin processes before one, it is wiser to assume that the Acker process and cell is still in the experimental stage of its development.

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The Italian Government has succeeded in connecting Sardinia with the Italian mainland by wireless telegraphy. The distance is one hundred miles, and the results obtained are said to be excellent.

SOME EXPERIENCES AND RESULTS DERIVED FROM THE USE OF HIGHLY SUPERHEATED STEAM IN ENGINES.*

BY R. LENKE.

In no branch of heat engine building has such an amount of study been spent as in steam-engines, from Watt's time up to to-day. The economy of the steam-engine is, in spite of all efforts, not the best, and the steam-engine in its highest perfection attainable at present cannot claim the first place in comparison with other heat engines. And so the problem of generating and using superheated steam has become a question, from the solution of which a considerable stride in improving economy has been expected and really made.

Superheated steam is generated by the addition of heat to saturated steam. The behavior of superheated steam is similar to that of gases; it is a very bad conductor of heat, and has the special peculiarity of being able to lose a certain amount of heat without becoming saturated or wet steam. The thermal capacity of steam is only 0.48, therefore very little heat is required to superheat steam, but as the steam loses the heat as quickly as it acquires it, every passage conveying superheated steam must be well covered with non-conducting material. Although there are some losses when using superheated steam on account of the heat radiation, they are very much smaller, because the loss of heat from superheated steam has lower calorific value than the latent heat of saturated steam. Superheated steam has a greater volume per unit of weight than saturated steam at the same pressure, hence one advantage, and the higher the temperature, the greater this advantage. At various pressures and temperatures the increase of volume may be taken from the following Table I:

TABLE I.

Pressure.	390 deg. F.	570 deg. F.	750 deg. F.
70	1.1	1.33	1.57
115	1.06	1 29	1.52
170	1.02	1.24	1.46

Table I shows that the higher the pressure is the smaller the increase of volume; and it is proved from practice that the advantage with lower pressure is indeed greater in proportion than with higher pressures.

The question may arise whether the increase of volume does not require more additional heat than the benefit derived from it is worth. To show this clearly, Table II has been prepared expressing how many B.T.U. less are required to produce one cubic foot of superheated steam than of saturated steam at the same pressure. For various pressures and temperatures the total heat per cubic foot is as follows:

TABLE II.

Pressure.	Saturated.	390 deg. F.	570 deg. F.	750 deg. F.
70	233	219	192	175
115	350	337	297	267
170	492		432	398

i.e., to produce, for example, one cubic foot of steam at 115 lbs. pressure and a temperature of 570 deg. F.,

$$\frac{350-297}{350} = 15 \text{ per cent.}$$

less heat is required than to produce one cubic foot of saturated steam at the same pressure. With saturated steam-engines, 20 to 25 per cent. of admitted steam is condensed during the admission period, consequently the practical steam consumption is very much in excess of the theoretical. Superheated steam does not condense during this period if sufficiently superheated, hence another advantage.

The economy effected by using superheated steam in engines is very remarkable, and, acknowledging this fact, a great number of steam users all over the world superheat the steam, although in many cases only a few degrees, yet a considerable saving in steam and coal is always the result. To obtain the full benefit the required temperature of steam is 660 deg. to 700 deg. F., and to stand this temperature the engines must be specially designed. It is not sufficient to use mineral oil with a very high flash point, and anyone who tries to supply an existing engine of any kind with steam at that temperature will have a very unpleasant experience, even when using the above mentioned oil.

The introduction of superheated steam into engines largely influences the expansion of the heated parts. Engines always gave great trouble when the distribution of metal in the cylinders was not uniform, as parts with more metal expanded most, and forced the cylinder walls towards the inside and made the cylinder out of shape. When using liners in the cylinders, they were squeezed in at the ends, decreasing the diameter, and jamming the piston body if sufficient clearance was not provided. With steam jackets heated with steam of 500 deg. F., the lubrication ceased as the cylinder walls became too much heated, consequently it was found necessary to do away with jackets, or if jackets were already provided, not to pass steam through them. Pistons constructed on the Ramsbottom type always worked satisfactorily, except in the case of pistons fitted with steel springs when they were in contact with highly superheated steam. Any kind of gun metal gets brittle after a short time, therefore valves, seats, and all parts in direct contact with superheated steam, must be made of cast-iron or other suitable mixture. Copper also loses about 40 per cent. of its strength at that temperature, consequently copper bends in pipes are not practicable. The best material for piping has proved to be wrought-iron and steel, each pipe being as long as possible, to have the least number of flanges. For long, straight pipe connections, provision must be made to meet the expansion, which is, at 700 deg. F., 0.0037 of the length, so that, for example, 100 feet of pipe extends 0.37 of a foot, or nearly 4½ inches.

Glands and stuffing boxes at first frightened users, so the engines were constructed single-acting to avoid the use of glands, but no serious difficulties have arisen on that account. It is advisable to place the stuffing box as far as possible from the cylinder end to keep it well away from the hottest parts, and to allow of as much radiation as possible. Sufficient clearance in the neck bush should be made to allow for the expansion of piston rod, and no metal with a melting temperature below that of the steam should be used.

Valves and valve gears are influenced in the same way by superheated steam. Valves containing many ribs or different thicknesses of metal (in section), such as plain slide valves or Corliss valves of the usual construction, are not suitable for high temperatures. A Corliss valve of medium size will stand 480 deg. to 500 deg. F., but no more, and the latter temperature very seldom. The smaller the plain slide valves are the higher temperature they will stand; large slide valves will hardly stand even slightly superheated steam if no provision is made for forced lubrication of the valve face.

Piston valves have proved to be most suitable for the highest temperature, owing to their uniform distribution of metal, but even with this sort of valve certain experience is necessary to get them in good working order. With ground valves the ribs holding the boss for the valve spindle must not begin within the working surface of the valve, but have to be placed beyond that, because they expand and make the valve polygonal. The valves must be ground in other liners to those in which they are to work in the engine; the former liners have to be smaller in diameter to secure more clearance to provide for the expansion of the valves; all ribs must be placed beyond the working surfaces of the valve. The cylinder expands in length more or less than the steam-chest, causing thereby deformation of the latter, which must be carefully considered in design. It is best to work the valves in liners fixed in the cylinder and with a small clearance, sufficient to allow for the deformation of the steam chest.

With this construction it is of course necessary to make steam-tight joints between the several ports, and this is best done by stepping the liners and seats and using narrow asbestos rings for each step. The liner is then forced on to the small seats by set screws in the cover, these asbestos rings making a lasting joint. Long valves cast in one piece become scored, whether they are cooled from inside with exhaust steam or not, consequently all valves should be made as short as possible. Rings and springs in valves cannot be recommended, as the steam comes behind the rings and increases the pressure, causing friction, and therefore increased oil consumption. As it is impossible to rely on tightness of piston valves, they must be made as small in diameter as possible. It may be stated here that superheated steam can travel at 30 to 40 per cent. higher speed through steam ports than saturated steam, and this fact has to be considered during construction. Two piston valves working one in the other, as the Rider or Meyer valves, are impracticable for superheated steam. If engines of that type are intended to be worked with superheated steam, each valve must work in a separate chamber. Double-beat valves can also be recommended as being safe, but they require a special arrangement, which is not always attainable with every gear. Very often it happens when warming up the engines that the valve spindles get hotter than the gland boxes, and on starting the engine the friction between spindle and stuffing-box is greater than the power of the spring, and if the valves are not positively driven, they remain open during a full stroke.

An engine constructed in accordance with the principles just explained is as safe with superheated steam as any other engine with saturated steam. From the experience over several years, it is not necessary to be bound to single-acting engines. Besides the economy, the use of highly superheated steam has some other advantages which are also important. It makes the steam consumption nearly independent of the size of engine as a small engine has about the same steam consumption as a large one; as for example, an 80 hp. compound condensing engine uses 10.45 lbs. of steam at 160 lbs. pressure, and a 1,000 hp. engine uses 9 lbs. of steam per indicated horse power per hour. The use of highly superheated steam does not require high boiler pressures—160 lbs. is the highest to be recommended, as no advantage can be derived by exceeding this. As the amount of heat transmitted from the steam to cylinder walls, and vice versa, is much lower with superheated steam than with saturated steam, the whole range of temperature from boiler pressure to vacuum can take place in one or two cylinders, so that the use of a triple-expansion engine does not make the slightest improvement in economy. It is not intended to be understood that the author proposes to do away with all triple-expansion engines for very large plants; their use will be necessary for constructive reasons.

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*Paper read in Section 3 of the International Engineering Congress, Glasgow, 1901.

With regard to economy obtained from engines working with superheated steam, the gain is derived from the larger volume of steam and the doing away with initial condensation. Generally the steam consumption of modern engines working under good conditions may be taken as follows: Single-cylinder condensing engines, with saturated steam and a pressure of 90 lbs. to 100 lbs. per square inch, use 19 lbs. to 25 lbs. of steam per indicated horse power per hour, corresponding to 373 to 490 B. T. U. per minute. The great difference in temperature between admission and exhaust steam causes much waste by initial condensation, and consequently this type of engine especially favors the use of superheated steam. With superheated steam the consumption has been lowered to 13¼ lbs. to 15 lbs., corresponding to 290 to 335 B. T. U. Non-condensing single-cylinder engines gave consumptions of 15 to 18 lbs. of steam per indicated horse power per hour, which is about the same consumption as an average compound condensing engine with saturated steam. The non-condensing compound engine decreases the consumption to 14 lbs. to 16 lbs. per indicated horse power per hour. The compound condensing engine is the most economical, and the economy obtained can hardly be reached by a quadruple-expansion engine working at a pressure of 300 lbs. The steam consumption of such an engine, either compound or tandem, at 140 lbs. pressure only, never exceeds 10 lbs. per indicated horse power per hour, and usually remains below, many tests having proved 8.5 lbs. and 8.8 lbs. consumption per indicated horse power. To utilize better these temperatures, and to work with various loads with safety and nearly uniform economy, Mr. Schmidt has introduced the receiver heater with automatic valve. The idea is to keep a steady mean temperature of cylinder walls not higher than will make the lubrication unreliable for different rates of expansion.

A few words may be said with regard to the cost of a superheated plant. Superheated steam-engines use on an average 30 to 40 per cent. less steam than saturated steam-engines of the same type. Consequently boilers can be made 30 per cent. smaller, and the difference in price will nearly cover the cost of the superheater. For the same steam consumption, the superheated steam engine is cheaper, as it may be worked with a lower boiler pressure, and it is simpler—i. e., instead of a compound engine with saturated steam, a single-cylinder engine with superheated steam may be used, giving the same or better results than the former.

With regard to oil consumption, it was found not to be more than that of an ordinary saturated steam-engine. For example: A 120 ihp. engine used in 24 hours 4 lbs. of oil, and a 300 ihp. Corliss compound engine 2.2 lbs. in 10 hours for both cylinders.

In view of the great advantages of steam-superheating, and the great number of engines running at present satisfactorily, it is astonishing that a few failures have caused prejudices among some engineers, who make the general introduction of the use of superheated steam very difficult. It will be worth mentioning that the result of a great number of trials have always proved a large saving in steam and coal, and with small plants and simple piston-valve engines, almost the same good economy is obtainable as with large engines with most exact valve gears. It is therefore recommended that superheated steam should be used in connection with all engines; the only question to be settled is the degree of superheat, which largely depends on local circumstances and the construction of the engine, and this matter should be left to the judgment of an experienced engineer.

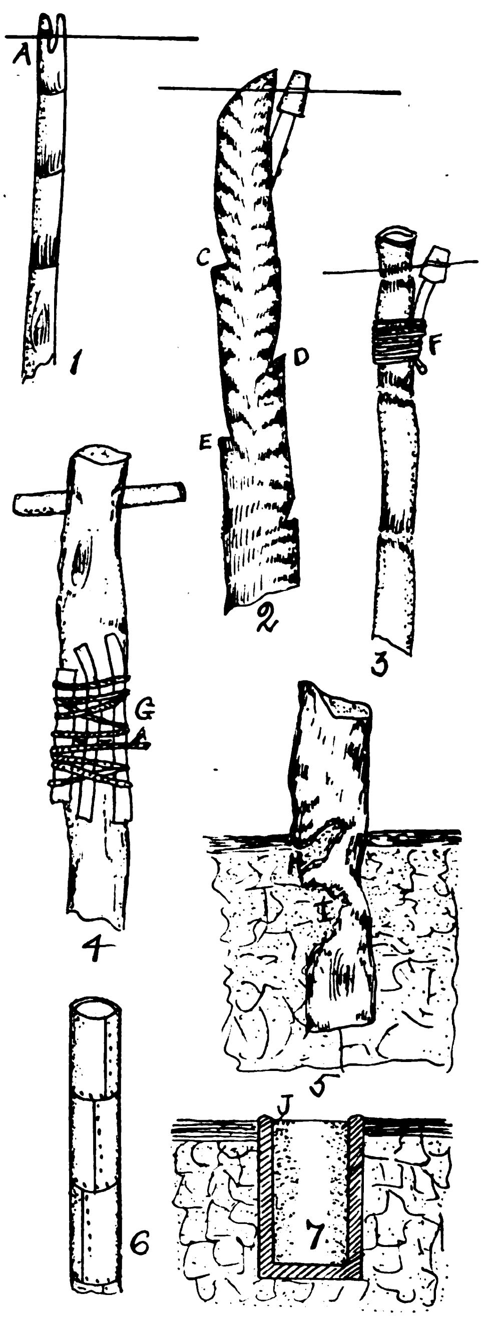
* * *

THE PHILIPPINE CABLE AND ATTENDING WORK.

BY "EX-PHILIPPINE VOLUNTEER."

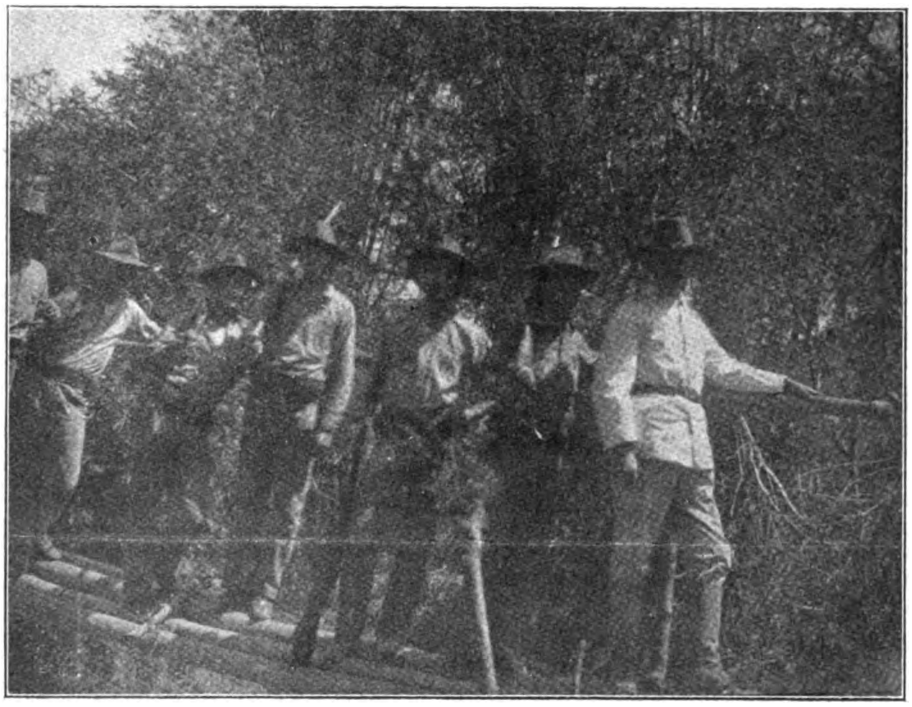
The incorporation of a cable company for the purpose of establishing a cable line to the Philippine Islands has awakened new interest in the telegraph system of America's new Eastern possessions. The establishing of this cable between the two countries will tend to increase telegraph and telephone lines in the islands, and in course of time the country will be well furnished with these methods of communication, whereas, at the present time, communication is carried on by courier, boats, stages or railroads. The important positions occupied by American troops have been joined by the wires of the signal corps, but these lines are chiefly for military uses. The native and other business men may, however, send messages over the lines of the military system by paying 2 cents per word for local messages, and but little more for messages intended for other islands in the Philippine group. But the putting in of the great cable system will evidently develop the telegraph system as employed in commercial pursuits. Therefore, the accompanying illustrations which are given in connection with explanations of establishing lines of wires in the islands may be interesting to the fraternity. Your correspondent served nearly three years on the islands, and for a portion of that time was detailed with the signal corps in putting in new poles and wires in new districts. Our chief trouble at that time was avoiding fights with the natives, for the signal corps has other business to attend to. Next came the difficulty of getting proper stock for poles. Fig. 1 shows the kind we used in many long stretches, consisting of a pole of bamboo, cut about 20 feet long, nearly five inches in diameter, by a native helper of our Filipino corps, and driven into the ground by pressure after forging a narrow opening with a pointed stick or bar, then the wire would be looped about one of the fork ends previously cut out as at A. The first typhoon would level miles of these poles. I have seen a water-buffalo come along and get his horns against a drooping wire supported on these poles and before he could be stopped, pull down half a mile of the frail devices. The next best is the cocoanut wood, and this can be obtained in many sections and used to advantage. In Fig. 2 is a pole of this sort.

These poles are cut by the native helpers as the work progresses and water-buffalos are employed to haul the poles from the groves to where wanted. Natives dig holes at proper depths for this kind of pole and also notch it with steps, C, D, E, etc., by which means the active native linemen are able to ascend the pole at any time. There is cedar on the islands, but it is not used very much for poles, cross-arms, or other line work, being mostly used in the cigar box making business. The habit of patching up poles and connections is common among the native linemen, of which there are now a large number in Government service. They do not use many cross-arms and often a number of wires are carried in singular fashion on the top of one pole. There has been a scarcity of experienced linemen until recently, and some of the line work has necessarily fallen into the hands of untrained Filipino helpers. These fellows are good workers as a rule, but of course inexperienced. Instead



Illustrating the Setting of Poles in Philippine Service.

of using nails or wood pins, in one case I observed that a squad of natives who were putting in a short branch line for a telephone between Santa Barbara and an adjoining station, used cordage as at F, Fig. 3. In another instance, cross-arms were made like that in Fig. 4. A peculiarity of some of the native woods is the freedom with which they break off short and square under heavy pressure or when undergoing the trials of the domestic heavy winds which sweep the valleys now and then. The writer has observed poles broken off short and patched as at G in the latter illustration.



Signal Corps Men on a Narrow Bamboo Footpath.

THE WORK OF THE WHITE ANTS.

Possibly one of the leading trials with which any cable or other company will experience in the islands will be the inroads of the millions of white and other wood-eating ants which infest every barrio. These ants move about in bodies of millions and select wood to live upon. They can eat into the white woods, and in fact nearly all the woods of the country, in a remarkably brief space. They select protected positions, such as those under the cover of the earth, and before one is aware, his house foundation is weakened because of the destructive work of the white ants, who are feasting upon the wood fiber in the posts of his residence. The same way poles of the telegraph system are eaten into, as at H and I in Fig. 5, and when a strain occurs, the pole topples over, broken off short, close to the earth. There is nothing else to do but put in another pole and take the chances of the ants moving on to another point. In some cases protection is found by the use of sheet metal covers, like that in Fig. 6, which are made large enough to surround the end of the pole which is submerged. But even these covers are often weak in one little point, and the ants find this particular spot and make a passage through to the relished wood. Again, cement or pottery protectors are used. There are numerous native potteries in the islands in which pots, bricks, pipe-ware, etc., are manufactured from the rich clay deposits of the islands. Lately these potteries have been turning out weighty but effective casings like that in Fig. 7, for sinking into the earth, and in which a pole is placed. The letter J indicates the case in section. The pole is put into position and packed tight with the clayey stuff, which hardens and makes an effective protection from the ants.

There are some odd ways employed of carrying a wire underground, or where it needs protection. The natural bamboo stock grows with partition walls at intervals throughout the center and in making the bamboo serviceable for pipes or other work which requires a clear passage, the partitions are knocked out with a punching pole. These partitions are merely bored through for wire service, as in Fig. 8. The portion of the side is sketched in open view, so as to show the principle of the partition service. This is at C, C, where the wire which enters at A passes through and emerges at B. The wire is thus sustained in the center of the wood protector.

BOTTLES FOR INSULATORS.

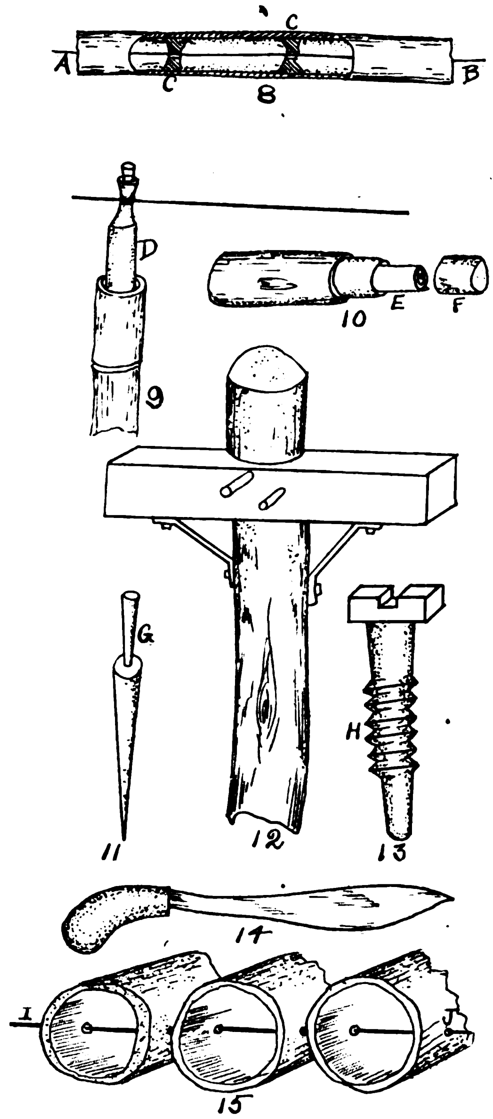
Fig. 9 shows the way in which bottles are utilized for insulators, when insulators of the proper kind are unobtainable. The bamboo pole is planted and the top cut off about 6 inches from the partition inside. Then the bottle is placed in the hole as at D and serves the purpose well until proper devices can be obtained.

CARRYING MESSAGES.

It always interested me to observe the singular methods employed by native couriers for carrying messages to points some distance from the stations. These had to be in waterproof covers, because the natives often forded rivers. In Fig. 10 is the type of carrier often used, consisting of a tube of bamboo, cut out about 8 inches long, and provided with a shouldered section over which fits the head piece F. This device receives the message enrolled and inserted as shown. Then the cap is pressed on tightly, and the device is usually tight to water, unless the cap is not properly fitted. Often the shoulder is further tightened by use of pieces of hemp.

A SOLID POLE.

Evidently when the new lines are put in to use for commercial purposes in connection with the new cable, the hardwoods of the forests will be cut and set up in good form, such as have been used to advantage in many of the recent military districts during the past 18 or 20 months. These poles are fashioned like that in Fig. 12. The wood logs are cut in the forests and hauled to the lines where work is in progress and where gangs of native workers are ready to trim the pole and put it in form for use. These poles are sunk deep and made very secure. The cross arms are of substantial wood selected for the purpose and sawed true. They are not hacked out with native tools. Wrought-iron braces are used, as shown, and the cross-arm is either screwed, pinned or bolted on. Shortage of metallic devices for this purpose compels the use of wood, native made pins, like in Fig. 11, devised by using a solid section bored through the top for the pin G, which pin is driven home after the pin is inserted, thus expanding the pin and making it fit so tightly that it can be relied upon. In Fig. 13 is a form of wood screw of native manufacture, in which there are a limited number of coarse threads at H, shaped laboriously by the handiwork of the patient native. These screws have been used to good advantage in pole operations. They cost about two cents each, and are made at the rate of ten per day by a native. Twenty cents per day is good pay for the native lineman or helper.



Showing Some Work Relating to Poles and Wires.

In Fig. 14 is the typical tool carried in the belt of the Filipino lineman. The blade is forged from wagon tires or other metals, after much laborious work, often lasting for weeks, a keen edge is put on and the cutting properties of the tool are remarkable.

Fig. 15 shows the way in which natives who have stolen wire from the lines utilize the wire for house building purposes. The bamboo poles are arranged parallel as shown, and bored through with holes to receive strands of wire which enter at I and come out at J. These wires are inserted at intervals of about 12 inches, and they serve to hold the bamboo securely in position for flooring, bridge surfacing, roofing, side walls, etc. Linemen make rafts after this fashion. That is, the native helpers do the work, and the raft is used to carry stores down stream.

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New Offices for an Old Bureau.

Progress and prosperity is evidenced in the extended accommodations which the Manufacturers' Advertising Bureau is occupying at its old time location, 126 Liberty street, New York City. The new offices give increased facilities, which have become necessary by the continued growth of the business done by the Bureau since its establishment in 1877.

The methods of the Manufacturers' Advertising Bureau have received the unqualified indorsement of the technical press and many representative manufacturing concerns of this country and Europe, some of which have been its clients for twenty years.

Benj. R. Western, the originator and proprietor, was the pioneer in the management of a firm's newspaper work and advertising, in what are generally termed the trade journals, as a business by itself, and is a recognized authority in his special field.

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Electrical Trades' Directory.

The "Electrician," London, will shortly have ready for distribution its Electrical Trades' Directory and Handbook for 1902 (price 12s. 6d.), containing a very carefully compiled list of British, Colonial and foreign electricians, electrical engineers, electric light and power and electric railway and tramway engineers and contractors, electro-chemists and metallurgists, electrical apparatus makers, plant and machinery builders, electrical, telegraph and scientific instrument makers, electric bell makers and fitters, electricity supply, telegraph and telephone companies, telegraph and telephone engineers, electric cable and wire manufacturers, and of all persons engaged in electrical pursuits throughout the world; useful tables and data relating to electric light and traction, electric power transmission, electricity supply undertakings, telegraphs and telephones, home and foreign government departments, etc.; also a biographical section, giving interesting particulars of the careers of about 350 eminent men connected with electricity in all its applications, with many portraits. Full particulars will be sent immediately on application to the "Electrician" office, Salisbury Court, Fleet street, London, E. C.

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An Automobile Lubricant.

The automobile is a self-propelled business or pleasure carriage. The three distinct types are the steam-carriage, the electric vehicle and the internal combustion engine. Each has its advantages and its disadvantages, but all three types are equally dependent on the proper working of their running parts.

Furthermore, in all three types it is really desirable to waste as little power as possible, and to do this, the running parts must not only run properly, they must also run smoothly and with the least amount of friction. For the best results, and for the greatest amount of pleasure to the occupants, the automobile must be treated as a machine,—the same as the locomotive or the stationary engine.

The power transmission between engine and axle is commonly by chain and sprocket, with a differential gear on the axle. To prevent rust and wear and to save power, all chains and gears should be lubricated with some form of graphite lubricant. It is graphite—Dixon's Pure Flake Graphite—that has proven most satisfactory for the chains of bicycles and for all types of machines up to the mightiest steam locomotive that rushes along at more than a mile a minute.

Dixon's Pure Flake Graphite is prepared in various ways so as to make it suitable for the running and wearing parts of all the different types of automobiles. There is no substance that can equal it is a lubricant, and it is generally used on all power machinery, large or small.

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INCORPORATIONS.

The Electro-Magnetic Brake Company, Pittsburg, Pa. Capital stock, $5,000.

The West Penn Light, Heat & Power Company, Allegheny, Pa. Capital stock, $1,000.

The International Trolley Controller Company, Syracuse, N. Y. Capital stock, $3,000. Directors: J. P. Devine, W. S. Farmer and H. S. Fulmer, all of Syracuse.

The Milwaukee Incandescent Light Company, Milwaukee, Wis. Capital stock, $12,000. Incorporators Jacob Hahn, C. Freytag and G. W, Chadbourne.

The New Martinsville Electric Light, Heat & Power Company, Wheeling, W. Va.—to manufacture and sell electricity for all purposes. Capital stock $50,000. Incorporators: Frank B. Hall, N. C. Hamilton, J. C. Brady, C. M. Ford and T. M. Garvin, all of Wheeling.

The Molly Falls Electric Light & Power Company, Marshfield, Vt.—to manufacture and furnish electric light and power in Marshfield, Plainfield, Cabot and other towns. Capital stock, $10,000.

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ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED NOV. 5, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

685,755. Controller for Electric Railway-Motors. Frank W. Garrett and Emmett W. Stull, Johnstown, Pa., assignors to the Lorain Steel Company of Pennsylvania. Filed April 8, 1901.

685,781. Electric-Railway-Motor Controller. Frank A. Merrick and Emmett W. Stull, Johnstown, Pa., assignors to the Lorain Steel Company of Pennsylvania. Filed March 13, 1901.

685,822. Switch for Overhead Trolleys. John H. Cook, Brooklyn, N. Y., assignor to Henry B. Newhall, Plainfield, N. J. Filed June 13, 1901.

686,017. Trolley. Milford J. Wilson, Painesville, O. Filed Feb. 21, 1901.

686,169. Car-Fender, William P. Tucker, Brooklyn, N. Y. Filed Jan. 29, 1901.

686,212. Mechanism for Operating Brakes. Anton Duppler, Jersey City, N. J., assignor, by direct and mesne assignments, to the Compound Magnet Brake Company and Magnet Car Brake Company. Filed Aug. 10, 1899. Renewed April 8, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

686,172. Electric Headlight-Lamp. Harlan P. Wellman, Ashland, Ky. Filed Nov. 14, 1899.

686,194. Electric Switch. Henry P. Ball, New York City, assignor to the General Incandescent Light Company, same place. Filed Nov. 13, 1900.

686,218. Incandescent Electric Lamp. Martin E. H. Forst, San Francisco, Cal., assignor of one-half to Robert J. Davis, same place. Filed March 29, 1901.

686,288. Cap for Incandescent Burners. George D. Scott, Birmingham, Ala., assignor to the Kitson Hydrocarbon Heating & Incandescent Lighting Company, Philadelphia, Pa. Filed March 1, 1900.

ELECTRICAL MACHINERY AND APPARATUS.

685,795. Means for Operating and Controlling Electric Motors. Charles J. Reed, Philadelpha, Pa. Filed March 22, 1899.

685,793. Method of Operating and Controlling Electric Motors. Charles J. Reed, Philadelphia, Pa. Original application filed March 22, 1899. Divided and this application filed May 8, 1901.

685,854. Motor Starting and Controlling Device. Christian W. Kragh, Madison, Wis., assignor to the Northern Electrical Manufacturing Company, same place. Filed April 9, 1900.

685,960. Electrical Ignition Device for Explosion Engines. Zebulon Wirt, London, Eng. Filed May 21, 1901.

685,966. Winding for Dynamo Electric Machines. John B. Blood, Newburyport, Mass. Filed March 1, 1901.

685,978. Electric Igniter for Gas-Engines. Jess B. Fenner, Buffalo, N. Y., assignor to the J. W. Ruger Manufacturing Company, same place. Filed April 4, 1901.

686,023. Armature for Electric Meters. Carl W. J. Busch, Munich, Germany, assignor to Luxsche Industriewerke, A. G., Ludwigshafen, Germany. Filed July 30, 1901.

686,133. Armature-Adjusting Device for Relays or Other Instruments. Ulysses G. Rogers, New York City. Filed April 19, 1901.

686,152. Motor. Albert W. Smith, Washington, D. C. Filed Sept. 9, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

685,846 685,847. Switchboard for Telephone or Like Exchanges. Howard F. Jones, Wilson, N. C. Filed Nov. 6, 1900, April 7, 1900. Renewed March 15, 1901

686,071. Telephone Toll Signal and Collector. Andrew Holzmann, Brooklyn, N. Y. Filed April 8, 1901.

686,206. Repeater for Telephone-Circuits. Clyde J. Coleman, Chicago, Ill., assignor, by mesne assignments, to George B. French, Boston, Mass., and Frank L. Hall, New York City. Filed Nov. 8, 1899.

MISCELLANEOUS.

685,742. Wireless Telegraphy. Archie F. Collins, Philadelphia, Pa., assignor to Charles A. Chase, same place. Filed March 31, 1900.

685,766. Magnetic Fuse Cut-Out. Noble Jones, Sparrow's Point, Md. Filed March 25, 1901.

685,776. Insulator-Support. Fred M. Locke, Victor, N. Y. Filed July 22, 1901.

685,797. Accumulator Electrode. Albert Ricks, Berlin, Germany. Filed May 18, 1900.

685,817. Magnetic Ore-Separator. William P. Cleveland and Camden E. Knowles, Joplin, Mo., assignors to the Magnetic Separating Company, same place. Filed May 7, 1900. Renewed May 8, 1901.

685,953. Method of Intensifying and Utilizing Effects Transmitted Through Natural Media. Nikola Tesla, New York City. Filed June 24, 1899. Renewed May 29, 1901.

685,954. Method of Utilizing Effects Transmitted Through Natural Media. Nikola Tesla. New York City. Filed Aug. 1, 1899. Renewed May 29, 1901.

685,955. Apparatus for Utilizing Effects Transmitted from a Distance to a Receiving Device Through Natural Media. Nikola Tesla. New York City. Original application filed June 24, 1899. Divided and this application filed Sept. 8, 1899. Renewed May 29, 1901.

685,956 Apparatus for Utilizing Effects Transmitted Through Natural Media. Nikola Tesla, New York City. Original application filed Aug. 1, 1899. Divided and this application filed Nov. 2, 1899. Renewed May 29, 1901.

685,957. Apparatus for the Utilization of Radiant Energy. Nikola Tesla, New York City. Filed March 21, 1901.

685,958. Method of Utilizing Radiant Energy. Nikola Tesla, New York City. Filed March 21, 1901.

685,965. Electric Furnace. Charles P. Bary, Paris, France. Filed Oct. 18, 1900.

686,020. System of Electrical Distribution. Frederick Bedell, Ithaca, N. Y. Filed Sept. 1, 1900.

686,043. Motor-Carriage. Henry Ford, Detroit, Mich., assignor to the Detroit Automobile Company, same place. Original application filed Dec. 8, 1898. Divided and this application filed Sept. 12, 1899.

686,073. Electrically-Controlled Combination Lock. William H. Hollar and Alonzo L. Rhodes, Philadelphia, Pa.; said Rhodes assignor to said Hollar. Filed March 20, 1901.

686,102. Steering Mechanism for Motor-Vehicles. Wilhelm A. Maybach, Cannstadt, Germany, assignor to the Daimler Manufacturing Company, New York City. Filed March 28, 1901.

686,128. Nipple for Electrical Conduits. Alexander C. Proudfit, New York City, assignor to Thomas & Betts, same place. Filed Dec. 24, 1900.

686,135. Electrical Sounder. Ulysses G. Rogers, New York City. Filed April 17, 1901.

686,137. Solenoid Graduating Tube. Ulysses G. Rogers, New York City. Filed May 24, 1901.

686,138 Electrical-Instrument Case. Ulysses G. Rogers, New York City. Filed June 5, 1901.

686,150. Differential Indicator and Electrical Alarm Attachment. John G. Jones, Howard G. Shortt and Edward G. Shortt, Carthage, N. Y. Filed March 11, 1901.

686,207. Auxiliary Signaling-Box. Charles W. Cornell, East Orange, N. J., assignor to the Gamewell Fire Alarm Telegraph Company, New York City. Filed March 22, 1900.

686,222. Electric Clock. Thomas E. Heeter, St. Louis, Mo. Filed Jan. 7, 1901.

686,228. Telephony. Isidor Kitsee, Philadelphia, Pa. Filed Feb. 20, 1896. Renewed March 1, 1901.

686,229. Locking Device for Steering Mechanism of Automobiles. Albert L. Kull, Camden, N. J. Filed March 20, 1901.

686,235. Running Gear for Motor-Carriages. Ralph L. Morgan and William H. Edmondson Worcester, Mass., assignors, by mesne assignments, to the American Bicycle Company, Jersey City, N. J., and New York City. Filed Aug. 24, 1900.

DESIGN.

35,266. Telephone-Transmitter-Box. Richard M. Eaton, Philadelphia, Pa., assignor to the Novelty Electric Company, same place. Filed Sept 23, 1901. Term of patent 8½ years.

THE TELEPHONE WORLD.

Modern Telephone System for Montgomery, Ala.

The new telephone system for which a franchise has been granted by the city council will begin building in Montgomery the first week in December, according to J. J. Dixon, who will be secretary and general manager of the new company.

Mr. Dixon recently went to Montgomery from his home in Birmingham. He was accompanied by Sterling A. Wood and S. M. Lovejoy, who are associated with him. P. T. Whilden will be president of the company.

"We came here to incorporate the company under the laws of the State, and we will complete this part of the work," said Mr. Dixon. "The organization as styled in the charter is the Alabama Telephone & Telegraph Company, I was for some time manager of the People's Telephone Company, the independent Birmingham organization, but I have been interested in Montgomery all of this year.

"Our Montgomery franchise provides that we cannot charge a greater price for telephones than $3 a month for business houses, and $1.50 a month for residences. It also provides that this company can never be transferred to any other company.

"The company is capitalized at $250,000, and we expect to spend every cent of this money in Montgomery. Among other improvements we will build a handsome office building, which will be equipped after the most modern fashion. Ground will be broken for the system the first week in December, and we expect to have it ready to be operated by June 1st of next year.

"I have just returned from New York and other Eastern cities, where I have made an investigation of all kinds of telephonic apparatus. We will use only high-grade instruments. I have selected the Stromberg-Carlson switchboard and instruments, and the system will be equipped with metallic circuits, copper wires and everything that is strictly up-to-date. Considering the low charge and the service which we will give the public we expect to put from 3,000 to 5,000 telephones in Montgomery the first year the system is in operation."

Mr. Dixon said that the company contemplated expanding and that after a year of operation in Montgomery connection would be made with all neighboring cities.

Rates of the Bell Telephone Company of Chester, Pa., have been materially reduced, the new schedule to take effect the 1st of January. The cheapest present rate for business houses, special circuit, is $90 for 900 calls, and six cents for each additional call. The new rate is $69 for 800 calls and five cents for each additional call. For a two-party circuit the present rate is $60 for 600 calls and six cents for each additional call. The new rate is $48 for 600 calls and five cents for each extra call. For a three-party circuit the current rate is $48 for 500 calls and six cents for extra calls, For residences, the new rate will be $60 for special circuits. 800 calls, with five cents for additional calls; $42 for two-party, 609 calls, and five cents additional; $36 for four-party, 600 calls, and five cents additional; $30 for six-party, 800 calls, and six cents additional, and $30 for a six-party, 500 calls, and six cents additional. A proportionate reduction is made for a higher number of calls. The managers will give no reasons for these reductions. Officials of other companies say the cheaper tariff is solely due to prospective competition.

The Jerseyville, Ill.. Telephone Company has moved into new quarters in the Leigh Building on Main street. The securing of the new quarters is a part of the improvements which the company is making to its system in that city. The exchange now has over 300 subscribers. The company, of which J. M. Page is president, is composed of local capitalists.

The New Lisbon, Ind., Telephone Company has filed articles of association with the Secretary of State, naming its capital as $5,000. The company will operate in Dudley, Liberty and Henry townships, Henry County, Ind. The directors are J. M. Mercer, John A. Miller, H. H. Koons and J. R. Leakey.

The Interstate Telephone Company, which recently purchased the Independent Home Telephone Company at Bridgeton, N. J., will put in an entirely new plant there. New quarters have already been secured and leased for ten years.

The new Arcadia, Wis., Telephone Company has announced that it will immediately start the installation of a new exchange in Arcadia. The old exchange, which was a very inferior one, will be torn out, and the new one completed by November 15.

The Jackson County Home Telephone Company, Jackson, O., has increased its capital stock from $50,000 to $75,000.

New Telephone Plan.

In order to accommodate its subscribers the Delmarvia Telephone Company of Wilmington, Del., has decided upon a new plan. The company has a number of subscribers in Newark. To telephone from the former city to the latter, costs a small fee, but the company thought that the Newark people should be given a better rate.

Each subscriber in Newark has been furnished with a book of coupons, each good for a talk over the telephone from Wilmington to their home in Newark. If a Newark subscriber desires to talk to Newark he can go into any place in Wilmington where there is a Delmarvia telephone, and talk by depositing a coupon with the owner of the telephone. This coupon is accepted as cash. The coupons can only be used by the subscriber and are not transferable. If they are used by any one other than the subscriber the company collects the cost of the telephone call from him. The plan has worked successfully and is a great accommodation to people of Newark who chance to be in Wilmington on business and want to talk to their home over the Delmarvia system. Making the coupons non-transferable protects the company under the system, and so far few people have violated the rule.

The committee appointed at a recent special meeting of the stockholders of the Badger State Long Distance Telephone Company of Janesville, Wis., for the purpose of reorganizing the company and placing its affairs on a strict business basis, held its first meeting a short time ago. All twelve members of the committee were present and the committee organized by electing C. W. Twining of Monroe, chairman, and F. W. Coon, Edgerton, secretary. A general plan of reorganizing was adopted and the chairman was authorized to appoint a sub-committee of five members to carry out the plan.

Rural telephone subscribers on the Independent Telephone Company's line running out of Port Byron, Ill., now enjoy the privilege of service into the tri-cities over the Central Union Company's lines. This important step toward connecting up the independent lines in the county with the tri-cities exchanges has just been consummated by the Central Union people and they are now in position to furnish communication to a considerable territory in the upper end of the county embracing the 180 subscribers of the Independent Telephone Company.

The St. Paul, Minn., city authorities are said to be preparing to bring action against the Northwestern Telephone Company to enforce payment of 5 per cent. gross earnings tax on its entire system in St. Paul. Their contention is that in accepting the council's permits for extensions the company has in effect secured a new franchise, for which it must pay the tax named in the new city charter.

B. F. Pankey, proprietor of the new Independent Telephone Company of Topeka, Kan., expects to have that exchange in operation by the first part of next month. All the plans for the Independent Company's line are being made in accord with the latest improved systems of telephony, and the indications are that Topeka will be given a good service at a moderate price. Mr. Pankey has not yet made public announcement of his rates.

J. Alexander of Clayton, N. M., representing the Plains Telephone Company, will put in a local telephone service in Woodward, Okla. The Woodward exchange will also be the central exchange for a number of long-distance lines, which have been needed there for some time.

W. B. Crossland, of Guthrie, Okla., is in receipt of a letter from Washington, D. C., stating that he had been granted a patent of his invention of a sectional telephone pole. This pole it is stated, is put together something like a jointed lightning rod, and can be shortened or lengthened at will.

The Gainesboro Telephone Company is greatly improving its exchange at Sparta, Tenn., putting in 50-foot poles and otherwise bettering its facilities. There are now 99 boxes on the exchange.

The West Kentucky Telephone Company, composed of Mayfield and Fulton capitalists, of which J. E. Wright, of Louisville, is manager, has filed articles increasing the capital stock from $25,000 to $30,000.

According to Dr. A. A. Stockton, a director of the New Brunswick Telephone Company, the city of St. John's, N. S., will not have the use of free telephones at the expense of the company.

With the 343 kilometers of telephone wires recently strung up at Monterey there are now 2,331 kilometers of telephone wiring in active service in the State of Neuvo Leon, Mexico.

New Belgian British Telephone Line.

The following has been received at Washington, D. C., from Consul Roosevelt, dated Brussels, October 10: "In a few days a new submarine telephonic cable will be laid, connecting Brussels with London. The point of immersion on this side will be near La Panne, and on the English coast the line will emerge at Ramsgate. The circuit will be so disposed as to serve large commercial cities of Belgium and England, such as Antwerp, Liege, Birmingham, Manchester and Liverpool."

In all probability within a comparatively short space of time the exchanges of the Automatic Telephone Company in New Bedford and Fall River, Mass., will be connected with a long-distance service. President Davol, when interviewed recently, said that the matter had been considered, but nothing definite had been done, although it was more than probable that the plan would be put in operation. A distinct company, or rather an individual, has made a favorable offer to do the work and maintain the line, and the completion of details regarding local arrangements at either end alone retarded the beginning of the work. It is expected that these affairs will be so adjusted that the long-distance service will be put in operation in the near future.

Another deal was made this month in telephone affairs. The sale of the Juniata and Susquehanna Telegraph & Telephone Company, which has been in operation from Sellin's Grove to Millersburg and Sunbury to Lewistown, Pa., and covers a distance of 260 miles, to the United Telephone & Telegraph Company. Quite a number of Shamokin, Pa., people are interested in these companies, amongst them being Geo. C. Graeber, John Mullen, E. G. Seiler, W. W. Ryon, E. M. Leader and John and Will Helfenstein.

John Enoch of St. Louis, Mo., has been granted a 30 year franchise to establish and maintain a telephone system in Kansas City. The grantee is bonded on $20,000 to begin work in 60 days. The ordinance provides for business telephones at $54, and residence telephones at $48 a year.

The directors of the Citizens' Telephone & Message Company of Fostoria, O., have decided to put in four additional long-distance toll lines and have declared a 5 per cent. dividend on common stock.

The new switchboard of the Michigan Telephone Company at Dimondale, Mich., will shortly be installed, giving direct communication between that town and Lansing.

About 200 men employed by the American Telephone Company have begun work on a line from Decatur, Ala., to Memphis, Tenn.

The Calhoun County Telephone Company of Marshall, Mich., has increased its capital stock from $100,000 to $150,000.

The Secretary of State of Indiana was lately notified that the Connersville Telephone Company had increased its capital stock from $25,000 to $50,000.

The Hudson River Telephone Company of Newburg will install a telephone system in Walden, N. Y,

A new telephone service is to be added to the modern conveniences in Ipswich, Mass.

The Northwestern Telephone Company of Defiance, O., increases its capital stock to $10,000.

TELEPHONE INCORPORATIONS.

The American Telephone Mutual Fire Association, Toledo, O.

The Farmers' Telephone Company of Steuben County, Angola, Ind. Capital stock, $1,500.

The Booneville & Tupelo Telephone Company, Booneville, Miss. Capital stock, $2,000. Incorporators: Philips, Hinds & Co., W. R. Whitesides & Co., B. A. P. Selman and others.

The Interstate Independent Telegraph & Telephone Company, Trenton, N. J. Capital stock, $8.000,000. Incorporators: W. Monds Greene, Nelson R. Vanderhoof and Charles N. King.

The Flat Rock Telephone Company of Seneca County, Tiffin, O. Capital stock, $5,000. Incorporators: C. C. Pfund, T. E. Wygant, S. D. Huff, E. F. Leinhard, W. H. Gardner and F. E. Harris.

The Williamson County Telephone Company, Taylor, Tex.—to construct, acquire, maintain and operate telephone exchanges and toll lines at and between all points in Williamson County. Capital stock, $100,000. Incorporators: James S. Brailey, H. M. Daugherty, W. H. Harper, Jr., J. E. Boynton and J. B. Earl.

GENERAL ELECTRICAL NEWS.

Lighting.

Amite City, La.—W. B. Senter contemplates establishing an electric light plant and ice factory.

Bessemer, Ala.—At a recent meeting of the city council an ordinance, which contains a contract with the Birmingham Railway Light & Power Company to furnish the city with arc and incandescent lights, passed its first reading. It is understood that the company will purchase the plant here.

Cape May, N. J.—Through the efforts of ex-Senator Lemuel E. Miller of this city a syndicate of wealthy Philadelphians has purchased from the W. O. Robb estate the Franklin electric light plant, which furnishes public and private electric lighting in this city.

Cleveland, O.—Councilman Springhorn is back of a movement to ask the next Legislature to authorize the city to issue $500,000 worth of bonds for the establishment of a municipal lighting system.

Colon, Mich.—A dam is being constructed by Eastern parties in the St. Joseph River near here to furnish power for electric lighting.

Douglas, Man.—The citizens are talking of having the town lighted by electric lights.

Downsville, N. Y.—The people of this place are making an effort to secure electric lights.

Estherville, Ia.—Eighty progressive business men of this city will sign a $1,600 note to permit the city to go ahead with the improvement of the electric light and waterworks plants which were interrupted.

Galveston, Tex.—The Citizens' Electric Light Company will enlarge and increase the capacity of its plant by the erection of an addition and installation of new dynamos, engines, etc. The cost will be $150,000. W. W. Chapman, general manager, can be addressed.

Globe, Ariz.—The Pinal Mountain Water Company is seriously considering the proposition to put in an electric light plant, and if it decides to do so, will make the rates for lights sufficiently low to induce their more general use.

Hancock, N. Y.—The taxpayers of this place have voted, 56 to 24, to authorize the trustees to make a ten-years' contract for lighting the streets with electricity.

Hartford, Conn.—The contract for the wiring of the State capitol for its lighting by electricity has been awarded to the New England Engineering Company of Waterbury, that concern naming the lowest figure of any of the dozen bidders. The price is approximately $10,000.

Jasper, Ala.—Mr. Hudnall of Ensley and associates, will apply for a franchise for the construction of waterworks and the erection of an electric plant at this place.

Kent City, Mich.—This city will soon be lighted by electricity.

Lake Providence, La.—The question of issuing bonds for waterworks and an electric light plant is being agitated.

Mansfield, La.—The city has voted $13,500 of bonds for the erection of an electric light plant and waterworks. The mayor can be addressed.

Marion, Ind.—The local business men are preparing to organize a co-operative electric light company.

Searcy, Ark.—A committee has been appointed to consider the plans for waterworks, electric light plant and ice factory. J. N. Rachels, chairman.

Warehouse Point, Conn.—The electric light company of Windsor Locks has decided to extend its lights to the streets of this village.

Whittier, Cal.—An electric light plant is to be established at this place in the near future.

Street Railways.

Allentown, Pa.—A charter was recently issued at the State Department to the Lehigh & Carbon Traction Company of this place. The line is 15 miles long and takes in all the towns between here and Walnutport. The capital is $90,000.

Atchison, Kan.—Superintendent E. L. Hillis, of the Soldiers Orphans' Home here will ask the next Legislature to appropriate funds with which to build an electric railway from this place to the Home, a distance of two miles.

Baltimore, Md.—The Maryland, Sparrow's Point & North Point Electric Railway Company of Baltimore County has been incorporated by Robert S. Carswell, Alvin N. Bastable, B. Stanley Carswell, William F. Stillwell and Alexander H. Schultz.

Chester, Pa.—The United Traction Company, which owns the trolley lines of this city, Wilmington, Reading and Lebanon, has in contemplation a continuous route from Wilmington to Harrisburg via Reading.

Concord, N. H.—Wallace D. Lovell, the electric railway magnate, says that if the citizens of Dovor, Concord and the intermediate towns will raise $200,000 he will furnish the remainder of the $1,000,000 required for the construction of an electric railway between the two cities, for which he holds a charter granted by the last Legislature.

Dahlonega, Ga.—This place is to have an electric railroad.

Fairmont, W. Va.—The Fairmont Electric Railway Company, of which John A. Howard, of Wheeling, is president, will expend $50,000 in doubling the capacity of its electric power plant. The contract for erection of a large power house will be awarded at once.

Galesburg, Ill.—A new electric line is talked of to run from here to Macomb. It is to be an extension of the one already laid out to Abingdon.

Girard, Pa.—It is reported that W. V. Culbertson of this place has purchased the right of way and will extend the Erie-Cambridge trolley line from Cambridge Springs to Titusville, Pa.

Leechburg, Pa.—A second trolley company has been chartered here. This company, organized under the name of the Leechburg & Apollo Street Railway Company, has secured franchises, and charters for two bridges across the Kiskiminetas River, one to Hyde Park, and the other near Apollo, were applied for. Capt. Alfred Hicks is president.

Lexington, Ky.—A $7,000,000 syndicate to build interurban electric roads between Lexington and other cities of the central blue grass region was organized here last week. The syndicate is backed by New York, Chicago and Detroit capital. The chief offices of the corporation will be at Lexington, and the main power plant, to be erected at a cost of $800,000, will be located here. The company's charter gives it the right to construct electric lines to Georgetown, Nicholasville, Winchester, Mt. Sterling, Versailles, Frankfort, Paris, Richmond and South Elkhorn.

Natchez, Miss.—W. A. Percy of Memphis, Tenn., is interested in the proposed street railway in this city, which will be about four miles in length if built.

Preston, Minn.—At a meeting of business men it was decided to incorporate the Minnesota & Iowa Electric Railway Company with headquarters here, the line to extend from Decorah by the way of Preston to Chatfield, and ultimately to the twin cities.

Saranac, Mich.—At a special meeting of the city council a franchise for an electric railroad was granted to E. L. Alvord and I. F. Tucker for the Saginaw and Grand Rapids Electric Street Railroad through the village.

Shawano, Wis.—Capitalists of this city and Green Bay are considering a project to organize an electric road stock company for the purpose of building a line from Green Bay to Shawano for both passengers and freight. The capital stock is to be $300,000.

Sioux Falls, S. D.—Col. Chase of Atlanta, Ga., who wants to establish an electric railroad between this city and Madison is inspecting same.

Toledo, O.—The project to build an electric railway from this city to Ypsilanti, by the way of Petersburg, Milan and Dundee, is said to be taking a definite form.

Topeka, Kan.—The board of county commissioners of Wyandotte County has under consideration the application of W. E. Winner for a new franchise in that county for the interurban electric railway which he proposes to build along the Kaw Valley from Kansas City to Topeka.

West Chester, Pa.—The Keeley Trolley Company of this place has been granted a State charter to operate trolley line from Phoenixville through Springs City to Birdsboro.

Manufacturing.

Mattapoisett, Mass.—There is a rumor that the old factory in the northern part of the town is to become a place for the manufacture of electric lamps, or else an automobile manufactory.

Montreal, Can.—Incorporation is sought for the Canadian Electrolytic Company, composed of Boston and Montreal capitalists, which propose to manufacture, refine and treat salt, lime, soda, bleaching powders, acids, alkalis and minerals of all sorts, by the electrolytic process. The headquarters of the company will be in this city. The capital is $300,000.

Trenton, N. J.—A certificate incorporating the Gas Appliance Company of America was filed in the county clerk's office a short time ago by Attorney Theodore Backes. The company is organized to manufacture, deal and sell all kinds of electrical and gas fittings on a capital of $10,000. The incorporators are Frank S. Moses, Thomas Mellick and John Tidgwell.

Worcester, Mass.—The Electrical Advertising Company of this city has recently been incorporated to manufacture and operate electric signs, which are controlled by strong letters patent, and in addition to making the electrical signs it will make other kinds of electrical devices for illuminating and decorative work. The vice-president and general manager is George E. Linton, and the secretary of the board of directors and treasurer of the corporation is Eugene C. Belknap.

Company Matters.

Fremont, O.—The Fremont Gas Company has changed its name to the Fremont Gas, Electric Light & Power Company, and enlarged its powers in accordance and increased its capital stock from $75,000 to $250,000. J. T. Lynn is president and W. B. Daly secretary.

New York City.—These retiring directors of the Electric Vehicle Company have been re-elected: H. M. Byllesby, George Chapman, G. H. Day, P. T. Dodge, T. W. Goodridge, Albert A. Pope, A. L. River, I. I. Rice and F. C. Stevens.

Trenton, N. J.—The Marshall Trading Company has changed its name to the Electric Properties Company.

Power and Transmission.

Griffin, Ga.—Seaton Grantland, W. J. Kincaid, J. M. Brawner and Chas. Wheeler will organize a company with a capital stock of $100,000 for developing the High Falls in Monroe County for furnishing electric power to this, and probably other cities.

Labarge, Mich.—The power plant, which the Thornapple Electric Company is building on the Thornapple River at this place, is expected to be in operation by the middle of December.

Montreal, Can.—The new extension to the electric works at Chambly will increase the horse power by nearly 15,000. This will give a total of 3,000 hp., to be controlled by the Montreal Light, Heat & Power Company and the Royal Electric Company.

Automobiles.

Cleveland, O.—The Western Automobile Company of this city was lately incorporated with $10,000 capital stock by R. M. Owen, Henry J. G. Melcher, Thomas McCansley, Henry R. Ahrens and W. E. Baldwin.

Colorado City, Col.—Kansas capitalists are planning the establishment of an automobile line in this city, which will cater to tourists, offering rapid transit of a modern kind to all points of interest at low fares.

Mansfield, O.—Beardsley & Hubbs, automobile manufacturers of this city, are moving their works to Shelby, and will occupy the old rib works building.

Saginaw, Mich.—Negotiations are pending between a local business man and New York men for a site on Tilden street for an automobile factory. The firm will have a capitalization of $250,000.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, November 11, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	35	37
Broadway and Seventh Avenue	100	246	250
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	164	164⅛
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	121	121¼
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	105	106
Brooklyn City Railway	100	240	242
Brooklyn Rapid Transit	100	66⅞	67
Baltimore United Railways, com	50	15⅜	15½
do. do. do. pref	50	91	92
Buffalo Railway	100	110	111
Cleveland City Railway	100	114	115
Cleveland Electric Railway	100	85	85¼
Columbus (O.) Street Railway	100	46	48
Jersey City, Hoboken and Paterson	100	19½	20¼
New Orleans City Railway, com	100	29	31
do. do. do. do. pref	100	104	107
North Jersey Street Railway	100	23½	25
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	30	34
do. do. do. pref	100	85	86
St. Louis United Railways, com	100	25⅞	26
do. do. do. pref	100	79¾	80¼
United Electric of New Jersey	100	16	18
PHILADELPHIA.			
American Railways	50	40¾	41
Citizens	50	359½	360
Columbus Railway	100	46	48
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	69	67½
Continental $29 paid	50	155	155¼
Consolidated Traction of Pittsburg	50	23½	24
do do pref	50	64½	64¾
Dayton Traction	100	156	156¼
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22¼
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151¼
Hestonville Mantua & Fairmount	50	48	48¼
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J	100	..	..
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	95⅞	96⅛
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	28½	28¾
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	178½	179
West End Street, com	50	94	94¼
do. do. do. pref	50	113	113¼
CHICAGO.			
City Railway	100	200¾	201
Lake Street Elevated	100	13	13⅛
North Chicago	100	190	200
Union Traction, com	100	13¼	13¾
do. do. pref	100	50	51¾

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23⅛	23¼
do. do. do. pref	50	64	64¼
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	49	50

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Electric Boat, com	100	18	19
do do pref	100	40	49
Electric Lead Reduction	100	2½	2⅝
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	1⅜	1⅞
do do pref	100	3	4½
General Carriage	100	⅞	1
General Electric	100	258¾	259
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	241	245
General Electric	100	258¼	258⅜
Massachusetts Electric Companies, com	100	36	36½
" " " pref	100	93½	94
Westinghouse Electric & Mfg., com	50	71¼	72
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	161	161¼
National Carbon, com	100	20½	20¾
do do pref	100	84	85
PHILADELPHIA.			
Electric Company of America	50	5⅞	6⅛
Electric Storage Battery, com	100	57	60
do do do pref	100	57	60
General Electric Automobile	50	¼	⅜
National Electric	10	11	11⅛
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1½
Philadelphia Electric trust ctfs. $5 paid	25	5¼	5⅜
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	92	93
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
BOSTON.			
American Telephone & Telegraph Company	100	157¾	158
Erie Telegraph & Telephone Company	100	21	22½
New England Telephone Company		132¼	132½
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co	100	106	109
Commercial Cable Company	100	175	184
Franklin Telegraph Company	100	47	55
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	120	123
Mexican Telephone Company	100	2	2⅛
New York & New Jersey Telephone Company	100	167	170
Pacific & Atlantic Telegraph	25	78	83
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		92¼	92¾
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	115
Cumberland Telephone & Telegraph Co	50	133¼	133½
Chesapeake & Potomac Telephone Company	100	72	75
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		78	84
Hudson River Telephone Company	100	109	112
Northwestern Telephone Company, guar	50	122	126
Providence (R. I.) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Nov. 11.

INDUSTRIAL AND MISCELLANEOUS STOCKS

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1⅜	1½
Eddy Electric Manufacturing Company	25	8	8½
Storey General Electric	10	9	12
Consolidated Car Heating	100	55	57
Standard Underground Cable	100	218	220
Pratt and Whitney, pref	100	84	92

STREET RAILWAY BONDS.

	Last Sale.	Int. Paid.
ALBANY.		
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent.	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117½	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅜@16⅝c.; Lake, 16¾@17c.; casting, 16½@16¾c.

The Interstate Independent Telegraph and Telephone Company, capital $3,000,000, has been incorporated in New Jersey.

Net earnings of the Brooklyn Rapid Transit for September decreased $41,085, and for three months $90,438.

The United Railway & Power Company is said to have bought the Wilmington and New Castle (Del.) Electric Railway and the New Castle and Delaware City Railway.

Directors of the Consolidated Traction Company of Pittsburg have declared the regular semi-annual dividend of 3 per cent. on its preferred stock as registered November 5.

The annual meeting of the Edison Electric Illuminating Company of Boston, which adjourned October 18 until November 7, has been further adjourned until November 22.

The Detroit United Railway Company has declared the regular quarterly dividend of 1 per cent., payable December 2. Books close November 20 and reopen December 3.

The Pratt & Whitney Company has declared the usual quarterly dividend of 1½ per cent. on its preferred stock, payable November 15. Books closed November 9 and reopen November 16.

A $7,000,000 syndicate to build interurban electric roads between Lexington and other cities of the central blue grass region has been organized at Lexington, Ky. The syndicate is backed by New York, Chicago and Detroit capital.

A dispatch from Cleveland, O., states that the Lake Shore Electric Railway Company has filed a mortgage for $6,000,000 in favor of the Western Reserve Trust Company that covers the Everett-Moore roads betweeen Lakewood and Toledo.

The Charlestown (Mass.) Gas & Electric Company has entered into a contract with the Edison Electric Illuminating Company of Boston to supply it with electricity for lighting purposes. It is expected that the Charlestown Neck plant owned by the Charlestown Company will be abandoned.

Advices from San Francisco, Cal., state that the entire system of the Market Street Railway Company has practically been sold to a Baltimore syndicate. It is stated that $26,000,000 in cash is to be paid for the property, and that the syndicate will expend at least $4,000,000 in improving the property.

Thirty million dollars is said to have been offered through the Chicago City Council to the street railway companies of Chicago for all tangible property owned by them in connection with the trunk lines, for which franchises will expire in 1903. Buffalo capitalists, it is reported, are willing to pay this sum.

The Atlantic Coast Electric Railway, owned largely by Standard Oil interests, has defaulted on the $20,000 interest due November 1 on its $800,000 5 per cent. first mortgage bonds. It is thought that default was intentional, to allow insiders to profit by a reorganization. The company operates from Pleasure Bay to Ocean Grove, N. J., 23 58 miles.

Elevated railway traffic in Chicago for October shows a daily average for the Metropolitan line of 96,020, an increase of 9,234, or 10.64 per cent., over October last year. The South Side Elevated carried 73,062, a gain of 4,241 passengers, or 6.5 per cent. The Northwestern Elevated handled 59.044 passengers, or 8,236 more than last year, an increase of 16 per cent. The Metropolitan, in the first eight months of its fiscal year, has increased its traffic 6.75 per cent. The Northwestern for five months has gained 3.7 per cent, and the South Side for ten months has increased 4.8 per cent.

A close student of the copper situation in New York says: "The figures that have been published in regard to the amount of copper now held, in first hands, in the country are interesting. They have, however, left out of consideration the amount held by the producers of the West in their own section. If the copper held at Baltimore and Perth Amboy amounts to 135,000,000 pounds, the amount in the country is at least 200,000,000 pounds, for there is, at Helena and other Western depots, some 75,000,000 pounds. I am sure that these figures are very conservative for I have but recently been given authoritative information from that region. From a consideration of published figures by the producers and the Government statistics, together with the information from reliable sources, I feel sure that 200,000,000 pounds is a small estimate of the copper now stored in the United States."

New York and Brooklyn traction stocks have the attention just now of the large operators in Wall Street. There was some realizing on Monday of Brooklyn Rapid Transit by speculators who bought it at much lower figures, but Metropolitan, on the other hand, which, according to plans now under consideration, will take over the Brooklyn Rapid Transit, was strong throughout the entire day, closing with an advance of 1⅛, at 164. Technical denials were made from both Metropolitan and Brooklyn Rapid Transit circles of any scheme for the amalgamation of the two properties. This was to be expected, however, and is quite in line with the policy pursued by Metropolitan interests, as, for example, the positive statement that Third Avenue would not be accepted by the Metropolitan at any price, and the subsequent acknowledgment that while this report was being put out the insiders had been picking up Third Avenue stock. The Brooklyn Rapid Transit directors met Monday, but announced afterward that only routine matters were attended to.

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EDITORIAL NOTES.

The Proposed American Exposition of London.

From May to September, 1902, there will be held at the Crystal Palace in London, England, an exclusively American Exposition. The object of holding this Exposition is to demonstrate the immense commercial development which has taken place in the United States during recent years.

The products shown will be exclusively American and will be divided into eleven classes. In the first class will be found everything pertaining to machinery and the mechanical industry, such as dynamos, motors and electrical apparatus of every description. Here also will be shown the latest type of locomotives, automobiles, bicycles, etc.

In connection with the Exposition a commercial bureau will be established where all necessary information will by supplied to exhibitors as to channels of trade, and the placing of goods upon the British and Continental markets. The bureau will be under the direction of a committee of representative American and British firms. As usual diplomas and medals will be awarded meritorious exhibits.

There is no doubt but what this proposed exhibition will materially tend to further increase the prestige of products manufactured on this side of the Atlantic.

* * *

Equipping the Elevated Roads With Electricity.

At the annual meeting of the directors of the Manhattan Elevated Railway Company, held on November 13, President George Gould in his report gave a very fair idea of how the electrical equipment of the road was progressing. The public has heard so much during the past few years regarding the immediate conversion of the road to electric power that statements on the subject given out of late have been looked upon by the public cum grano salis. However, it would really seem now as though progress was being made—if slowly—and that before another year rolls around the cinder-generating demons, by courtesy called engines, as well as the eye ruining lights in the cars will be things of the past. President Gould in his annual message to the stockholders among other things said:

"During the last year the improvement and enlargement of the company's facilities have been steadily pushed. The line from Tremo to Fordham has been completed and put in operation since July 1, opening a highly promising field for growth.

"The new terminals secured in the Bronx district have enabled us to give additional and improved facilities to the public on our east side lines, which have met with an immediate response in increased traffic. During the year the change to electrical equipment has made great progress. The buildings for the central power station at East 74th street, and sub-stations at Allen street, 34th street and 99th street, are completed, and the machinery is being rapidly installed in all of them.

"Motor equipments are arriving in quantity, and deliveries of 300 new cars will commence within two weeks. Our engineers expect to turn the first 8,000 hp. engine and dynamo by December 1 and run the first trains on Second avenue during the month, to be followed up as rapidly as the equipment can be assembled and put in operation."

The third rail, according to the report, has been laid along the Second avenue line as far as Chatham Square and work is now in progress extending the new equipment from that point to South Ferry.

It can truthfully be said that the speed with which the Manhattan road is being converted from steam to electricity, does not compare favorably with that shown by the Metropolitan some time ago in changing its power from cable to the underground electric system.

* * *

Another Alleged Electrical Cure for Cancer.

We have frequently referred in these columns to various alleged electrical cures for tuberculosis and cancer. Another cure of this nature has been brought to our attention, the invention, so it is claimed, of a Dr. Gilman of Chicago. Dr. Gilman's method as explained by him is simple. The patient is given remedies which will supply material needed for the rebuilding of the destroyed tissue, and he is subjected to the influence of the X-rays every day for a few weeks or months, as the case may be, in order that the cancer may be destroyed. Referring to the subject the Chicago physician is reported as saying:

"We are in the beginning of an era when

cancer will have no terrors. In the last year and a half I have treated over fifty cases of cancer, including many forms of the disease, and have yet failed to find a single one that would not yield readily.

"I am of the belief that the disease can in the future be broken down quickly and surely, even when treatment does not begin before the disease is well advanced.

"The Roentgen rays, are of great power in the destruction of disease germs. I have found them of great value in killing the germs of tuberculosis.

"The X-ray pours light and electricity through the cancer and destroys the germs, at the same time stimulating the activity of the starved parts. The medicines which I give during the treatment, and which vary with the different patients, supply the material, lacking in the system, for the restoration of normal tissue.

"I have thus far lost only one patient whom I have treated for cancer by the aid of the rays, and that one died of weakness, caused by her inability to take nourishment."

It is to be hoped for the sake of humanity in general that Dr. Gilman's treatment will prove to be the cure that has so long been sought for in vain. However the statement of Prof. von Leyden, the chairman of the German National Committee of Inquiry as to cancer, which recently met in Berlin, is certainly not encouraging. He says:

"It is beyond conclusion that hereditary cancer is of comparative rarity. Our labors are still incomplete, but one thing is certain—the world still lacks a cure. Theories and suggestions only continue to multiply. Our plans contemplate exhaustiveness and decisiveness, ut the results are difficult to foretell."

* * *

A Bill Looking to the Improvement of our Consular Service.

Among the many subjects to come up for consideration in the Fifty-seventh Congress are a number of great importance to manufacturers engaged in oreign trade. Early in the session the bill providing for a reorganization of the consular service, introduced last year but not acted on, will come up for consideration. While a variety of propositions have been under discussion for the improvement of the consular service, the service has, to a very considerable extent, improved itself, and is winning frequent expressions of commendation from business interests which have received substantial aid, not only from the published reports, but also from the individual efforts of consular officers to meet the growing requirements of American industry and enterprise. While of course no one expects consuls to sell goods or to obtain orders for American manufacturers, or to do the work which every successful manufacturer must do for himself, it is well understood that valuable assistance has been rendered to our foreign trade by those of our consuls who are fully alert and alive to the conditions surrounding them. By raising the entire consular service to the highest degree of efficiency, the efforts of exporters to introduce American goods abroad will be greatly facilitated and reinforced. This is the aim of the reorganization bill of Representative Burton. No class of manufacturers has a more direct interest in the betterment of the consular service than those engaged in the manufacture of electrical apparatus and appliances, and those interested in foreign trade can do themselves no greater service than by personally enlisting the assistance of their members of Congress in support of the pending measure.

In view of our great progress and development in manufacturing industries, especially in the line of electrical work, which now far exceed the ability to supply our own wants, and in view of the urgent necessity of securing more extensive markets abroad, it must be apparent to everyone who has given the subject the least thought that there is an urgent demand for the establishment of a department of the public service to have the charge of and to aid in our industrial development, and to secure us better and more extensive markets abroad. The time is unusually opportune for the establishment of a department of commerce and industries, and never was there more need of such a department than to day. President Roosevelt is believed to be in sympathy with the proposed department, and it is understood that he will recommend the establishment of such a department in his annual message to Congress. That body then should give heed to the demands of our manufacturers and legislate to the end that the department may be created.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

THE annual meeeting of the electrical committee of the Underwriters' National Electric Association will be held at the New York board rooms, 32 Nassau Street, beginning 10 A.M. Tuesday, December 3.

◆

THE Falls of Glomen, in Norway, are to be utilized for the operation of an electric generating plant almost as large as the one at Niagara.

◆

PROFESSOR GORHAM of Brown University is said to have succeeded in extracting from a decayed porterhouse steak sufficient illumination to take photographs of laboratory apparatus. Professor Gorham is seeking to find an artificial light in which the element of heat is not contained, and believes he is on the road to definite results. He is connected with the bacteriological department of the University.

◆

EIGHT acres of ground for the site of the National Standardization Bureau have been purchased in the District of Columbia about a quarter of a mile west of Connecticut avenue on Pierce Mill road. The principal consideration that led to the selection of this site is that it is free from mechanical and electrical disturbances of all kinds, and has an elevation satisfactory with respect to atmospheric conditions. Plans for the buildings have been prepared, and their execution will be commenced upon the approval of the plans by the board of visitors, which convenes in December. The buildings provided for are a laboratory and a power house, the entire cost of which will be about $250,000.

◆

THE Magnetic Club will have its dinner at the St. Denis Hotel in this city to-night, November 20. Thomas F. Clark, vice-president of the Western Union Telegraph Company, will make a short address, after which there will be a variety entertainment. The dinner will be attended by W. C. Humstone, president of the Telegraphers' Mutual Benefit Association, together with delegates of that association from nearly all the large cities of this country and Canada, as well as several of the leading officials of the Western Union Telegraph Company, Commercial Cable Company, Postal Telegraph Cable Company, New York Telephone Company, Western Electric Company and nearly all the other well-known electrical establishments.

◆

THE Chamber of Commerce of Manila has cabled to President Roosevelt, urging that the Pacific cable be laid, and saying that the main object would be an immense increase of the rubber industry of the Philippines, estimated at $15,000,000, and also economy and the facilitation of business.

◆

FIRMS likely to be interested in the proposed American Exposition to be held in London from May to September, 1902—and which is referred to more in detail elsewhere in this issue—may obtain any desired information on the subject by addressing Messrs. Alfred H. Post & Co., Produce Exchange, New York.

◆

F. W. CH. JANISCH, chief engineer of the German electrical firm of Siemens & Halske, Berlin, after spending four months in the United States for the purpose of inspecting American electrical methods, returned to Europe Saturday by the North German liner Hohenzollern.

◆

A GREAT deal of special work was required in Havana's new trolley line. While some of the streets are broad and spacious in the Cuban city other streets traversed by the cars are exceedingly narrow. The trolley wire supporting pole on one side of a narrow street is attached to the house, owing to lack of space for its location on the curb line. These poles are of pipe, built to form trusses. The two trolley poles on the car are necessitated by the overhead return system adopted, it being feared that the use of the rail would be unsatisfactory for this purpose during the dry season.

◆

THE Commercial Cable Company announced last Saturday that its steamship, the Faraday, sailed on Friday from Waterville, Ireland, to lay a cable from this country to Fayal, Azores.

◆

COTTON mills to be run by electricity are projected in Oklahoma.

◆

PROF. EDWARD C. PICKERING, director of the Harvard Astronomical Observatory, has made a discovery that, in his own words, opens up possibilities of a very great future, and which bids fair to revolutionize all chemical and physical theories of the final composition of matter. A streak of lightning was caught at Harvard Observatory last July and a photograph taken of its spectrum. From such a small beginning two epoch-making discoveries have developed. Not only are the chemical elements so called compounds, but in the opinion of Prof. Pickering it is likely that hydrogen itself, which chemical scientists have thought to be the one element of which the others would sooner or later prove to be compounds, seem to be of composite nature. Prof. Pickering furnishes the above infor mation in explanation of his circular of the 16th inst., on the "spectrum of lightning," taken July 21. Other photographs were made at about the same time. The photographs showed the curious fact that the spectrum of lightning is not always the same.

◆

The twin 6,000 hp. generating units, which the Edison Electric Illuminating Company of Brooklyn, N. Y., has put in its power house in 66th street, were inspected last week by the executive committee of the company. The two giant engine generators are the largest in the world. One is in operation and the other will be soon.

◆

A cat was the cause of a great deal of trouble to the International Traction Company and the Niagara Falls Power Company a short time ago. Puss climbed a trolley pole on the Buffalo and Lockport Electric Railway at Hoffman, a small hamlet west of Lockport, N. Y., and tried to walk on a feed wire. Her tail touched the parallel wire that carried the current back to Niagara Falls. There was a flash that could be seen for miles as the 24,000 volts of electricity passed through her body, which was burned to a crisp. Her lifeless body fell across both wires, and did not drop to the ground. This short circuited the current and caused a fuse at the Niagara Falls power house to burn out. The power was immediately cut off from all the lines running out of the power house. It was two hours before the cause of the trouble could be located and the charred body of the cat removed from the wires. In the meantime power was shut off from a great part of Western New York and hundreds of cars on electric railways were motionless.

◆

A new dynamite gun of destructive powers has been privately subjected to a series of tests at Fisher's Island by a special board of officers of the Bureau of Ordnance of the United States Army. For several years the Government has been engaged in the creation on Fisher's Island of a veritable Gibraltar which will render the eastern entrance of Long Island Sound impregnable to any naval attack, and thus protect all the shore cities from New London to New York. In this great scheme of defense the dynamite gun covering the narrow channel between Fisher's Island and Plum Island, on which formidable batteries have also been erected, plays an important part. The gun is mounted on a seacoast carriage, permitting an elevation of 35 degrees and a train through the full arc of the circle, power for this purpose being supplied by electric motors placed under the carriage. With the caliber projectile it proved its ability to hurl 500 pounds of nitro-gelatine, sufficient to annihilate any ship afloat, a distance of about 3,000 yards, with a degree of accuracy, the experts declare, not excelled by the most improved types of large caliber rifled guns. With smaller projectiles the range was almost doubled without any sacrifice of accuracy.

◆

Electricity probably will supplant the omnibus horse in the conveyance of persons to and from the railway stations and the hotels in Chicago. Such is the belief following the announcement that a syndicate has been formed to purchase and take over the property and business of the Frank Parmelee Company, which does most of the transfer business. The men behind the project are John J. Mitchell, Roger B. McMullen, C. H. Randle, James. B. Wilbur, Norman B. Ream and J. C. Schaffer.

◆

Arrangements have been made with George C. Tilyou by the Wireless Telegraph Corporation, recently organized, whereby the company will establish stations at Tilyou's Steeplechase Parks at Rockaway Beach and at Coney Island, N. Y., using the dome on the main buildings at the places mentioned. The company will establish these stations with a view to communicating with ships at sea and to transmit messages to Manhattan.

◆

One of the chief improvements incident to the installment of electricity on the Manhattan Elevated Railroad's system in this city will be the new 110th street station, which will be at Manhattan avenue, on the great curve from Columbus avenue and 109th street to 8th avenue and 111th street. The construction already has been begun, an excavation for the foundations of the station being now in evidence, as well as some of the steel frames and girders for the structure.

◆

Electricity is to be used to a large degree hereafter in the treatment of many cases at the Kings County Hospital, in Brooklyn, N. Y. A static machine, said to be the finest in existence, has recently been purchased at an outlay of $1,400. Accompanying the static machine is an X-ray apparatus, which will be used on patients when occasion arises. Nervous diseases and sufferers from rheumatism will also be treated by electricity.

◆

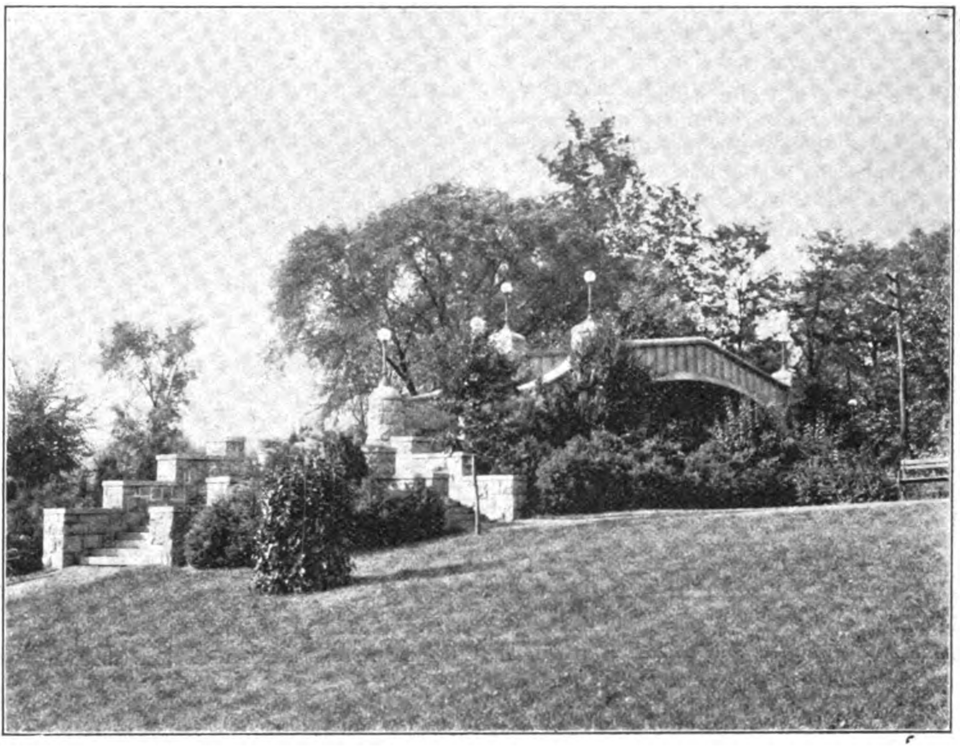
The advent of B. H. Kroger, who owns over forty retail and wholesale groceries in Cincinnati, O., into the bread-baking business, by establishing a plant, baking bread by electricity, and thereby inaugurating a bread war by underselling all bakers, now threatens gigantic opposition to the United States Biscuit Company, or the trust in all the big cities of the country. In addition to his local plant, Kroger is rapidly concluding negotiations for one in this city and if it proves the success that is expected, he states that he will establish other plants in Philadelphia, Pittsburg, Baltimore, Washington, Chicago, and other big cities.

ELECTRIC ORNAMENTATION OF A PARK BRIDGE.

BY H. G. TYRRELL, C.E.,
Boston.

The accompanying photograph illustrates the electric lighting of a park bridge, recently built at Madison, N. J. It serves the double purpose of a foot-bridge, and a park ornament The eight electric lamps, four at each end, mounted at the top of ornamental standards, serve to add grace and prominence to the bridge, both by day and night.

It spans two tracks of railway where they cross the park in a cutting.



Park Bridge at Madison, N. J.—Electricity for Ornaments.
(Designed by H. G. Tyrrell, C. E., Boston, Mass.

The center part of the bridge is a steel plate girder, built in the form of an arch. It has a clear span of 50 feet, and a width of 10 feet. The two girders, are connected at the bottom with light beams, and between these are laid curved sheets of corrugated iron, which carry the concrete and pavement.

The girders are held in a vertical position by gusset plates riveted to stiffeners on the web, and fastened to the floor beams. Beneath the floor are cross braces in the plane of the bottom chord, and at each end there is a vertical cross frame. The girders are capped with heavy cast-iron hand rails.

On the outside of each girder there is built a projecting fascia, representing an elliptical arch, thin at the crown and increasing in thickness towards the abutments. These are built of ornamental stone work, and on top of the stone newel posts are set the electric lamps.

The whole structure is surrounded with plants and shrubs, and presents altogether a pleasing appearance.

PRINCIPLES OF DYNAMO CONSTRUCTION.—II

(Written for ELECTRICITY.)

Calculation of Magnetic Circuit.

When an iron circuit that has been magnetized be interrupted by an air gap a strong field is at once apparent at the points marking separation. (Fig. 7.)

Although it appears to be the strongest point in the circuit, in reality it is the weakest; and in order to bring the strength of field at that point to a stage of magnetization equal to that of the iron at any point, additional ampere turns must be employed. These turns can be calculated by the formula:

FOR AIR.

NC = ampere turns.
B = total flux.
L = length in cms.
Q = cross sections in sq. cms.

Ampere turns $= \frac{8}{10}$ total flux × length in cms. ÷ cross section in square cms., or

$$NC = .8\,B\frac{l}{q}$$

For the convenience of those unaccustomed to the French system the formula is given for inches and square inches.

FOR AIR.

L = lengths in inches.

$$NC = .32\,B\frac{L}{Q}$$

Q = cross section in sq. in.

It must not be forgotten that these two formulas are only used for a medium whose permeability is constantly one as air.

In all calculations involving lines of force and ampere turns it is taken for granted that ampere turns are to be obtained. In order to use the formula, therefore, it is necessary to know the number of lines of force required. As an example, if it is required to know how many ampere turns must be used to force 100,000 lines of force through a body of air 1 inch long and 5 inches in cross section—

$$NC \quad .32 \times 100{,}000 \times \frac{1}{5}$$
$$= 6{,}400 \text{ ampere turns.}$$

Taking a case involving the air gap of a generator in which the pole face is equal to 100 square inches and the air gap ¼ of an inch thick, the formula would give with 1,000,000 lines of force—

$$\text{Ampere turns} = .32 \times 1{,}000{,}000 \times \frac{\frac{1}{4}}{100}$$
$$= .32 \times 2{,}500$$
$$= 800.$$

SATURATION OF IRON.

As the iron becomes more highly magnetized a peculiar condition results. Iron cannot be magnetized to an indefinite extent. After the specific induction has passed a certain point of high value the M.M.F. required for but a slight addition in the field constantly increases until the iron does not answer any more than the air, to an increased M.M.F. When such is the prevailing state of affairs the iron is said to be "saturated" or incapable of efficiently using further ampere turns.

As the iron becomes heavily magnetized its permeability drops in inverse proportion. The magnetization curve clearly shows the bend at which any increase of lines of force is only obtained at a great sacrifice.

The point considered as most economical is at the knee or bend of the curve; from this point on the disproportionate increase in M.M.F. for slight increments of field begin.

The condition of annealed wrought-iron when approaching this stage of strong magnetization can be made evident by its permeability curve.

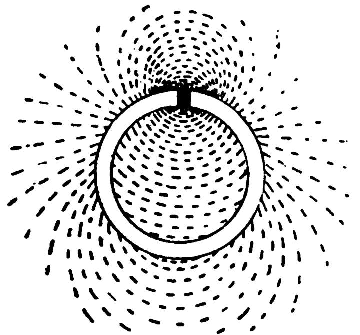


FIG. 7.

The value of μ is least when B is greatest, and in the curve shows the rapid decrease from its maximum value of 3,000 when the induction increases from 4 to 19,000 per sq. cm.

Cast-iron, by its inferior qualities as compared to wrought-iron, can only be magnetized sufficiently within small limits. Its specific inductance is generally about one-half that of wrought-iron or steel, because a higher magnetization is commercially impossible, due to its less permeable properties.

The two curves, Figs. 8 and 9, show a great correspondence but a great difference in scope; the final magnetization of the cast-iron being but the point from which, in the wrought-iron, the permeable quality begins to strongly exhibit itself.

It is impossible to give a formula for the exact calculation of lines of force without any previous knowledge of the iron used.

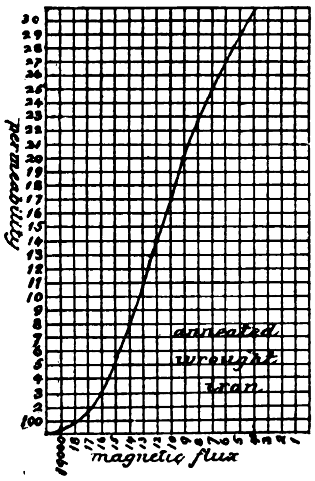


FIG. 8.

Kapp makes this remark in his book on "Transmission of Power," Chapter IV, page 105: "As yet no formula rigorously true for all degrees of magnetism has been found, and the difficulty is principally due to the fact that the chemical composition and the molecular properties of the iron play an important part, which is not easily determinable beforehand." He adds to this statement by admitting the possibility of formula being used (with a magnetization below saturation point) that are sufficiently approximate for practical purposes.

Fleming in his "Alternate Current Transformer," Chapter II, page 27, remarks as follows: "Experiment shows that the ratio of B to H expressed by the quantity μ is not of a determinate character, and that the value of μ, so far from being constant, is dependent on the whole previous history of the iron, on the value of B, and on the nature of the magnetic changes the iron is undergoing, viz., whether H is increasing or diminishing."

Faraday called the permeability the conducting power of a magnetic medium for lines of force.

There are many things that change the permeability of iron. Of a series of samples cast at the same time in the foundry there will be striking differences in their respective specific inductions when exposed to the same magnetizing force. These differences may be traced to general causes, such as blow holes in the iron or steel and different rates of cooling.

As these differences may throw out an engineer's calculations regarding his field it may become necessary at some future date for the foundries to cast their metal so as to have it at a fixed initial permeability, and each foundry could circulate these facts for its own benefit to those interested commercially.

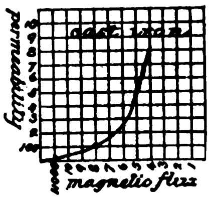


FIG. 9.

The same practice is carried on to-day as regards the conductivity of copper at a fixed temperature. As a parallel case, the iron could be tested and advertised as capable of a certain specific induction at a rated magnetizing force.

Of all methods used for the design of a magnetic circuit there is none less tinctured with empiricism than that of Hopkinson.

Frolich employed a system involving the use of certain constants which has practically fallen into disuse on account of the difficulty of applying it.

Hopkinson, however, takes the standpoint of differentially considering the magnetic circuit. He treats the armature, air gap, magnet cores, yoke and pole-pieces separately, and having obtained the ampere turns necessary for each respective part, makes a sum total of them and applies that number of ampere turns to the magnets.

The leakage coefficient is also considered to complete the method, which is so exact that, according to Thorburn Reid, between the calculated and actual results in a special case a difference of only 3 per cent. occurred.

This formula, by which electro-magnetic design may be said to have been put upon a sound basis, is given as follows:

$$\text{Total ampere turns} = \left\{\begin{matrix}\text{ampere turns}\\ \text{for}\\ \text{armature}\end{matrix}\right\} + \left\{\begin{matrix}\text{A. T.}\\ \text{for}\\ \text{magnet cores}\end{matrix}\right\} + \left\{\begin{matrix}\text{A. T.}\\ \text{for}\\ \text{keeper}\end{matrix}\right\} + \left\{\begin{matrix}\text{A. T.}\\ \text{for}\\ \text{pole pieces.}\end{matrix}\right\} + \left\{\begin{matrix}\text{A. T.}\\ \text{for}\\ \text{air gap.}\end{matrix}\right\}$$

This is an unsymbolic exposition of the

formula, which is used in connection with curves, or tables containing the same data.

It must be remembered that the only indeterminate quantity about iron is its permeability. Were this of a fixed and definite value, as for air and the majority of the non-magnetic metals, the calculations of lines of force would be an exceedingly simple process.

This changeable condition of iron, with its enormous variations in magnetic output when under the influence of different ampere turns, is such that unless some curves, tables or something equivalent be consulted, it is a most difficult thing to predict the magnetic strength at all without experiment.

If a certain sample of iron be tested for its permeability or an experimental machine be built, it becomes possible to approximate the permeability of the iron at different periods.

Therefore the use of curves taken from samples of the same kind though not of that particular quality will be of the utmost advantage in this respect.

BLUE-PRINTING BY ELECTRIC LIGHT.

In a recent issue of the "Railway and Engineering Review" is an account of the new offices and shops of the Union Switch & Signal Company at Swissvale, Pa., in connection with which mention is made of apparatus designed for making blue prints by electric light. The arrangement consists of a vertical glass cylinder, 3 feet in diameter and 5 feet high, mounted on a revolving base, so that it may be rotated about a fixed center, and thus facilitate the loading and unloading operations. On this center line, and over the cylinder, there is an electric arc lamp of 1,100 watts capacity, which may be made to gradually descend through the center of the cylinder to the floor, by means of an escapement mechanism and a system of pulleys.

More in detail, the glass cylinder is made in halves and held together by brass bands, top and bottom. For the purpose of printing, the tracing to be reproduced is laid on sensitized paper and both are wrapped around the cylinder with the tracing next to the glass. The upright at one of the joints in the glass carries some horizontal flat steel springs, to the ends of which vertical strips of wood are attached, which act as clamps to hold the first edge of the tracing and sensitized paper. The tracing and printing paper are held in place by a fabric curtain, one vertical edge of which is permanently secured to the upright at one of the joints in the glass. To the free edges of the canvas are attached, by tension springs a number of hooks which hook over a metal rod on the upright at the opposite joint in the glass. The spring hooks insure an even pressure everywhere and give the best possible conditions for securing perfect contact. In fact, tracings that have been folded and badly creased can, with a little care, be made to come down to excellent contact.

The arc lamp is then lowered slowly, the center of light coinciding with the axis of the cylinder, so as to maintain a uniform intensity of light at all points of the tracing on a level with the arc. As the light descends through a distance corresponding to the height of the tracing all parts of the sensitized paper are equally affected.

This method of printing as used by the Union Switch & Signal Company requires an exposure of a little less than a minute. As a matter of comparison, equally sensitive paper used in sun printing, through a Pittsburg atmosphere (which must be seen to be rightly appreciated), requires 10 to 12 minutes. The process is available at night equally as well as in day time. The Union Switch & Signal Company officials say that for their extensive blue-printing business they have found this apparatus indispensable.

The installation of this apparatus was made by the Pittsburg Blue-Printing Company, Park Building, Pittsburg, Pa. The accompanying illustrations show the arrangements of the cylinder, and the clock and pully devices for lowering the electric light. The speed of the lamp's movement, and hence the time of the exposure, is adjusted to suit different brands of paper by properly setting the pendulum bob on its rod and thus altering the length of the pendulum.

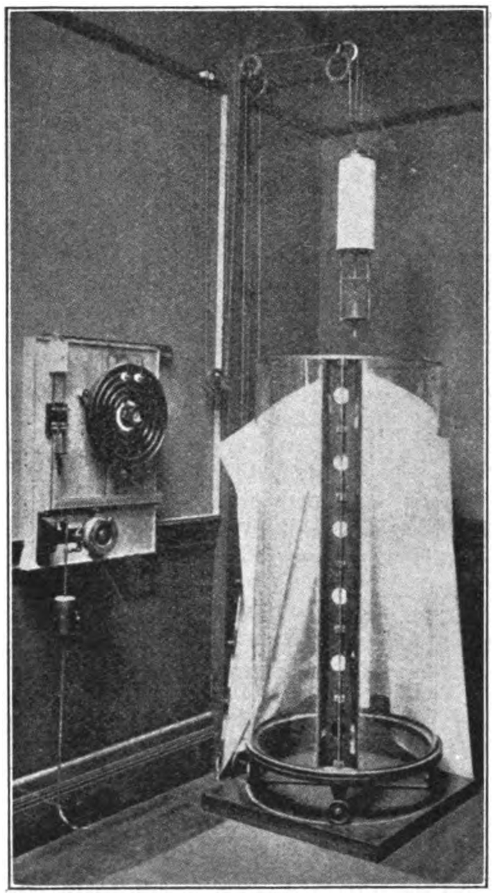


Fig. 1.

Glass Cylinder Uncovered—Cylindrical Electric Blue-Printing Apparatus

The machine is made in various sizes, accommodating tracings from 30x42 inches, in the smallest, to 42x84 inches, in the largest. Each tracing occupies but one-half of the cylinder, so that two prints may be made at once. Attempts have previously been made to print by electric lights, but as the previous plans have been with flat surfaces, groups of lights have been necessary, and this has resulted in spots of uneven printing.

Futher information on the apparatus is contained in a paper by Mr. S. B. Whinery, read at the October meeting of the Engineers' Society of Western Pennsylvania, and in a discussion of the same, from which the following extracts have been reprinted:

The cylinder is made of the best quality of plate glass, and must of course be perfectly free from bubbles or flaws of any kind. The plate is first rolled flat and polished. It is then laid on a semi-cylindrical mould and both run into the furnace. As the glass softens by the heat, it sinks into the mould and gradually conforms perfectly to its surface. It is not possible to get an absolutely perfect half cylinder of glass by this means, since the expansion of the mould in the furnace must necessarily alter its form slightly. The deviation from a true semi cylinder is, however, very slight and does not affect the practical working of the apparatus, even where the most sensitive paper is used. After bending, the glasses are again polished and marked to show the plates bent in each pair of moulds. In this way the best possible results in fitting up the two halves are obtained. The corresponding half-cylinders are set up in the position they occupy in the finished cylinder, and the wooden strips front and back are trimmed to conform perfectly to the surface with which they come in contact. By means of this perfect fitting, rigidity of finished cylinder is secured and the glass protected from cracking by an even distribution of the strains. The wooden strips are next put in position and the whole bound rigidly together by the brass bands, top and bottom. The canvas cover is cut to fit each cylinder. This cover is first put on the cylinder and then stretched to conform to the glass and to take out all creases by soaking it thoroughly with wood alcohol.

The base consists of the base plate proper and the base ring. The base ring is supported on four small cast-iron wheels and consists of a cast-iron ring, to which is screwed a wooden ring, which latter is fitted to the cylinder after being screwed to the iron ring. The base ring revolves freely about a pivot in the base plate, thus adding greatly to the convenience of operating.

The arc lamp used with this machine has been especially designed and adjusted for this work and gives a very white light of high actinic power. It is an inclosed arc, constant current lamp, with exceptionally long arc and correspondingly high potential difference across the terminals. The standard direct current lamp consumes 10 amperes of current while the alternating current lamp requires 15 amperes. An 18 ampere lamp is also built, to meet conditions where printing by the standard lamp would be too slow, such, for instance, as printing through bond paper or making black or brown prints. Taking the standard direct current lamp on 110-volt circuit, the power of consumption will be about 1.1 kilowatts, giving a candle power of about 2,000. Experience has shown that the best printing effect is obtained by burning the lamp upside down, i. e., with the positive carbon on the bottom. I might add that exhaustive experiments with practically all makes of carbons have proven that the American carbons are very much inferior to those of German make.

The auto-gear is a simple escapement mechanism, with a long pendulum rod and easily adjusted weight. Although the motion of the lamp obtained by this mechanism is, of course, not absolutely uniform, it is so nearly so that the difference is hardly noticeable. The drum which carries the cord by which the lamp is suspended, is so constructed that it can be disengaged from the escapement wheel by a slight outward pull, for raising the lamp. The weight of the lamp is partially counterbalanced by suitable weights in order to reduce the pull on the drum cord to about 3½ lbs.

DISCUSSION.

Mr. Scott—We have in use several of the

cylindrical machines such as have been described, and the fact that we cannot get blue prints has ceased to be an excuse for not getting things done. I was through part of our drafting department and the gentleman in charge explained the ways of ordering the prints from the blue-print room. He had several colors of cards. One card was simply for a general order; another color indicates that the blue print is to be had in an hour; another card indicated that the print is wanted within three hours. That such a system can be in operation shows that the conditions are very different from what they used to be. I have watched the machines at work and they are very simple and interesting to look at in operation. With the smaller prints we get a number at the same time, so that taking small prints and counting each as a blue print, the output in numbers would be considerable.

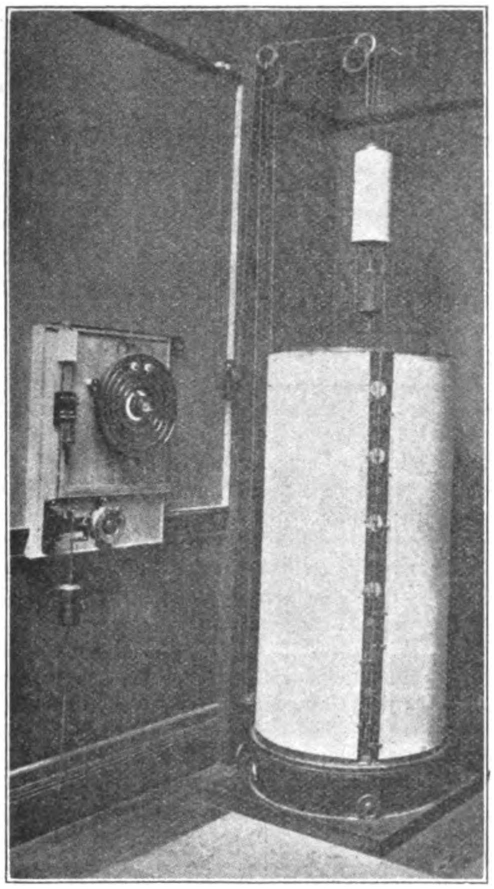


FIG. 2.

Tracing Wrapped for Printing—Cylindrical Electric Blue-Printing Apparatus.

Mr. Whitcomb—The work of the apparatus is very successful. As Mr. Scott has said a large number can be printed at the same time. The time required varies with the intensity of the light. The average time I should say is about two minutes. We never took any measurements of the power required but it is very economical, as the power is not burning during the entire time. The lamp can be switched off until the frame is loaded again, and, of course, it is not in operation. With continued attendance at one frame, it takes about one minute to load the frame. The time required to print, two to two and one-half minutes, would make about three minutes for two prints the full size of the frame, that is each side of the cylinder. Those prints are 42x60. If the prints are made so that they can be cut up the number is, of course, multiplied. This is the case in a great many instances. Of course, if those are counted as each being a separate blue-print, the total number is increased a great deal. We have made as high as 900 to 1,000 on one frame in one day with prints of that nature.

THE BALANCING AND FEEDING OF A MULTIPLE-WIRE NETWORK.*

BY O. DEWEY.

Judging by the number of towns in this country which have adopted, or are about to adopt, an electrical supply of continuous current using the three-wire system for distributing the supply from the generating station to the consumer's premises, there appears to be little doubt that for a general system of supply, such as is required in the majority of our towns, where we find not only are we called upon to supply lighting but also motive power, this system is considered to be the most suitable. With the introduction of the high-voltage incandescent lamp the three-wire system, as applied to the distribution of electrical energy upon anything like a large scale, received a new lease of life. Almost immediately after the lamp had been put upon the market the engineers in charge of undertakings which were already using the three-wire system, but with a pressure of only 200 volts or thereabouts across the outer conductors, commenced to think about doubling the pressure on the consumer's installation, and after one or two of our leading engineers had actually started to change over, the fever caught on, and in a very short space of time most of the undertakings followed suit so as to reap the various advantages which the alteration affords—to the central-station engineer at all events. If the high-voltage lamp had not made its appearance until three or four years later, there is every probability that we should have heard considerably more of the five-wire system, such as was installed in Manchester about eight or nine years ago, and which is still in operation throughout the central portions of the city. This system enabled the energy to be sent from the station at about double the pressure which was possible with the three-wire system. The extensions into the outlying districts are carried out upon the three-wire system with 200 volts on the lamps by simply extending the two outers and middle wire of the original network, so that Manchester is about the only town which has been so long in operation which was able to make use of the high-voltage lamp without the slightest alteration having to be made to the plant in the generating station. In spite of all the arguments which were brought forward against the practical value of the five-wire system, and of all the bogies which were raised as to the great difficulty that would be experienced in keeping the voltage equal between all of the five conductors, they did not prove to be anything like so terrible as the opponents of the system prophesied, and the difference in pressure between any two wires and any other two rarely exceeded about 2 per cent. Of course, it was very necessary to be careful about the proper arranging of consumer's installations between the five distributors, so that as far as possible the installations themselves would balance one another. In the case of a large consumer, whose consuming devices aggregated more than, say, 10 kw., the contractor who was wiring the installation was required to split the lights up on to four approximately equal circuits. The service for this consumer would be a five-wire one, and the house circuits would be connected to all five, a separate meter being provided for each circuit, or, if there was no special reason for registering the amount consumed by a particular circuit of lamps, a five-wire meter, Thomson or Aron, was fixed for the whole installation. However great the care might be in the arranging of the installations, it was impossible to avoid a certain amount of out-of-balance current, and this was dealt with automatically by means of motor-generators. When designing any multiple-wire system of distribution, not the least of the many points which have to be considered is the method by which the balancing is to be carried out. This point, like many others in the electrical world, is one upon which exists a considerable difference of opinion. In a large number of stations, especially the smaller ones, multiple-wire feeders are employed, in which case the pressure on either side of the middle-wire feeder, and consequently on either side of the middle wire of the distributors, can be regulated from the station, this being usually done by altering the number of effective cells on either side of the battery. If the battery is the only means by which this regulation can be carried out, and all the feeders are in parallel, it will be impossible to keep the voltage equal between the middle wire of the distributors and the outers at all points of the network, as any alteration at the station will affect the whole of the feeders, and it might easily happen that one portion of the network is very well balanced and, at the same time, another portion might be very much out. It is therefore advisable in the case of three-wire feeders, and where it is necessary to do all the regulation from the station, to have the smaller units wound for a pressure suitable for connecting to one side of the system only, and then the feeders can be split up into groups, each group being regulated independently of the others. Some engineers in this country do not consider it is necessary to use multiple-wire feeders, and only use two wires feeding on to the outers of the distributors. When a multiple-wire system is fed by this method, it will at once be seen that the main switchboard in the generating station is very much simplified; in fact, the station resolves itself into a two-wire one as far as generation is concerned. If the network is a large one, it will not be sufficient to have a set of balancers at the generating station only, for, as before explained, the balancing of the network, and consequently the voltage, might be very different in one district from what it is in another. It is, however, advisable that one set at least should be installed in the station, as it will probably be found that the one set will be quite able to deal with all the out-of balance current after the night load has gone off, say after midnight. Of course, if the station has a battery this will be used for balancing purposes, but it would be extremely unwise, in the author's opinion, to rely wholly upon this. This balancing device, whatever it may be, will be connected to a set of distributors forming part of the network, if the network passes through the station. If the distributors do not actually run through the station, special mains should be run from the nearest point of the distributors to the works. In addition to the balancing machines at the station, sub-stations will have to be erected at different points on the circuit in which balancers can be installed. The number of these stations and the distances apart at which they should be fixed, will, of course, depend upon the character and magnitude of the demand, and no special rule can be made for determining these points. It is very necessary, however, that the engineer should give serious attention to the proper location—perhaps we might call it electrical location—of these sub-stations, as it is quite certain that if the distance between them is too great, an unequal pressure on consumers' installations will be the result. This was the system which was adopted in Manchester in connection with the five-wire network, and as this undertaking, according to some people, was going to present such great difficulties as regards balancing, it would perhaps be of interest to some of your readers to give a description of the arrangements used for equalizing the pressure between the five conductors forming the network. The sub-stations which are used exclusively for balancing purposes are three in number. They are constructed underground, and were originally lighted by means of deck lights, which, however, proved unsatisfactory, owing to the difficulty experienced in keeping them water-tight; these were removed, and only artificial illumination was employed. Each station was sufficiently large to contain two complete sets of balancing machines and all switch gear in connection therewith. The sets each consisted of two separate machines, each machine having two similar windings upon the same shaft, which revolved in a field common to both windings. The two machines were mechanically coupled together by means of a flexible coupling. In the first set of balancers that were put down, the two sets of field magnets were excited off one pair of the 100-volt mains, the two being connected in parallel. This method of exciting is all right so long as the network is in normal condition; but it will at once be seen that if a short-circuit takes place between the pair of mains from which the exciting current is obtained, the field of the whole set instantly dies away, and there will be no tendency on the part of the balancers to burn out the fault. The balancing sets which were put down in later years were not excited in the manner just described. The four limbs forming the two sets of magnets were all connected in series, and the whole series was connected across the two outers of the five-wire network. This arrangement proved to be much more satisfactory than the method which had been employed previously. In the event of a shortcoming on between any of the five mains, the field was still excited as long as the plant at the station could be kept running, and, therefore, the balancers would work against the fault, and if it was not of too great a magnitude, it would be possible to burn it out without interrupting the supply altogether. The shunt winding was excited quite independently of the four armature windings, a Siemens' shunt switch being used for making and breaking the circuit. The shunt switches which were employed in the first instance were of the double-pole type, and were so constructed that on opening the circuit a resistance equal to that of the shunt winding was introduced in series with the shunt; the shunt was then short circuited, and, finally, the circuit through the non-inductive resistance was broken. The type of switch is, no doubt, suitable if employed with low voltages only, but with 400 volts it proved to be exceedingly dangerous, and the author had rather a serious accident when using one. It happened on one occasion that it was necessary to start up and shut down a particular set of machines two or three times in quick succession. When it came to starting up the third time, the current which was left in field winding started an arc across the 400 volt terminals, to which the leads for the shunt were connected, and as there were no fuses in the shunt circuit, the arc was maintained until the two 7\14 cables feeding the shunt switch were fused by the enormous current taken by the arc. The author was operating the switch at the time, and was rather severly burned on the face and hands. This was the second time these shunt switches had caused serious trouble, so the use of them was discontinued, and Siemens' well-known switches were fixed to take their places.

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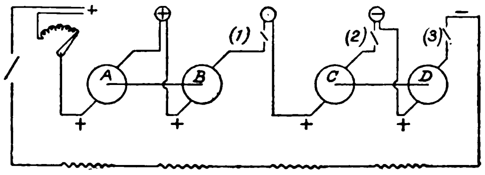
*From the "Electrical Engineer," London.

The accompanying diagram shows the connections of a set of motor-generators for the five-wire system. To set the combination to work, the shunt switch was first closed, which at once gave the field the full excitation. The armature, A, was then switched on to one pair of the five wires through the starting resistance, which resistance was cut out of circuit as the machines came up to speed. When full speed was attained the switches marked 1, 2 and 3 were closed, thereby connecting the other three armatures to the mains. When this was done the armature connected to the pair of mains upon which there was the lightest load acted as the motor, driving the others as generators. All the switch gear was especially designed by Mr. C. H. Wordingham, city electrical engineer, and was so arranged that it was impossible for the switches 1, 2 and 3 to be closed until the whole of the starting resistance had been cut out of circuit. All these sub stations were run from about 7 A.M. until 11 P.M., after which the set of balancers in the main generating station was sufficient to deal with the load. It was not found necessary to keep a man in attendance all the time the machines were running, and one man was able to look after all three stations, visiting them in turns during an eight hours' shift.



The following figures will show the differences in pressure between the five mains with and without the balancers running. Of course, when I say without the balancers running, I mean without one particular sub-station running; there would still be two other sets at work on the network, and also the set at the generating station:

	+	(+)	0	(—)
Balancing	101.4	101.5	101.5	103
Not balancing ..	101	99.5	101	106

Greatest difference when balancing = 1.6 volts.

Greatest difference when not balancing = 6 5 volts.

In the outlying districts, where only the three-wire system was in use, with 200 volts on the lamps, the balancing was done in the same manner, but of course it was only necessary to have a single machine with two windings on the armature, instead of the two machines, as in the case of the five-wire system.

Another arrangement which was adopted in Manchester for balancing a portion of the three wire network was put into operation by the author a few months ago. For the purpose of feeding the outlying districts high-tension three-phase current was transmitted to sub-stations, where it was converted to low-tension continuous current, this being supplied to the outers of the network, as in the case of two-wire feeders. The static transformers in the sub station were connected in star fashion, and by means of a connection between the middle wire and the center point of the star, the middle wire was maintained at a potential half-way between the positive and negative conductors. This method of balancing is a very great advantage, and being able to do it in this manner is a very strong point in favor of using rotary converters instead of motor-generators for feeding a three-wire system with continuous current. Before the last-mentioned method of balancing was put into actual use on the circuit, a few experiments were carried out in order to find out the sensitiveness of the arrangement.

The high tension mains from the generating station not having been joined up throughout the whole of their length, two complete sets of sub-station plant were used for the purpose of carrying out these experiments, one set being used for stepping up and the other for stepping down again—viz., the first rotary converter was supplied from the network, and the output on the three-phase side was transformed up to 5,000 volts, and after being transformed down again to about 250 volts was used for driving the second converter on the three-phase side, The continuous-current side of the second converter was connected to the outers of a three-wire system, which was so arranged that the number of lamps on either side of the middle wire could be altered as desired. The middle wire was connected through a switch to the center of the star of the low-pressure winding of the transformers belonging to the converters supplying the continuous current.

First condition—Balancing switch off, and 2 × 16s on one side of the middle wire and 3 × 16s on the other:

	+	3×16s	0	2×16s	—
Volts, balancing switch off		168		236	
" " " on		203		203.2	

The lamps were then altered until 13 × 16s were on the one side and only 1 × 16 on the other, a condition which it would be almost impossible to obtain practice.

	+		0		—
		1 × 16		13×16s	
Volts, balancing switch on		203		202.5	

Of course it was impossible to take the pressure without the balancing wire being connected in this case, as if the pressure had been put on with so great a difference in the numbers of the lamps, the 1 × 16s would have burst. These currents were, of course, very small to be much of a practical test, so the experiment was tried with a much larger load, so as to produce a drop in all of the apparatus employed. This was done by having two liquid resistances in series across the continuous-current side of the converter, the wire from the star connection being tapped on between the two tubs.

Current, 55 amperes	+	0	—
Not balancing..........	172 volts		220 volts
Balancing	196 "		195 "
Current, 70 amperes.			
Not balancing........	169 volts		218 volts
Balancing	193 "		192.5 "
Current 100 amperes.			
Not balancing..........	184.2 volts		190 volts
Balancing	189 "		189 "

One of the outer plates was then lifted completely out of the tub, and 100 amperes left on the one side only, the conditions then being that the 400 volt converter was supplying current at 200 volts or thereabout.

+	0	—
No current		115 amperes
185 volts		187 volts

These figures will show how very well the arrangement worked, and the above experiments were well borne out by the behavior of the machines when working on the network under normal conditions. The only disadvantage of having a large network fed exclusively by two-wirefeeders is that in the event of a fault coming on to the network, it is impossible to split it up so as to let each feeder supply a distinct portion of the system, as it is necessary to have some balancing device across each portion which is isolated, and it is not likely that one would have as many balancing stations as there were feeders. In the author's opinion the best arrangement for a large cross-connected network would be to have most of the feeders two wire ones, and have a few multiple-wire feeders, so as to enable the network to be split up into small sections for localizing faults.

THE DIESEL MOTOR.*

The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, acting through its Committee on Science and the Arts, investigating the merits of the Diesel Motor, reports as follows:

The Diesel Motor is an improved motor of the class known as "internal combustion" engines, and therefore, before beginning an examination of its claims to novelty and award, a brief review of the principles of such motors may be appropriate.

Practically all modern internal combustion motors, including the Diesel, operate upon a cycle first enunciated by Beau de Rochas in 1862, in which the combustible, either gas or hydro-carbon vapor, is introduced in one stroke, compressed in the next, ignited and burned in the third, and exhausted in the fourth, there being but one power stroke in every four.

The principal feature in all engines of this class has been the compression of the charge, it having been found that by using the momentum of the flywheel to compress the charge of mixed combustible and air, a notable economy and ease of working was effected. This principle was first practically utilized by Otto, in 1876, and his engine has been extensively used, both in Europe and America, principally employing illuminating gas as fuel. Various trials have shown for such engines a thermal efficiency decidedly higher than the steam engine, the proportion of heat converted into work ranging from 17 to 22 per cent. in various instances, while in the case of the steam engine and boiler combined 12 per cent. thermal efficiency is considered high and has been attained only by large engines under favorable conditions.

In 1897, Herr Rudolf Diesel read a paper before the Verein Deutscher Ingenieure, at their convention at Cassel, describing his studies in internal combustion motors, and his successive attempts to realize his ideas in practice. Herr Diesel began by assuming that the highest efficiency would be realized by the accomplishment of the Carnot cycle, and then proceeded to devise a motor in which, so far as was practicable, this cycle should be produced in actual operation.

The Carnot cycle is formed of two isothermal and two adiabatic curves, the expansion during the reception of heat being such as to maintain a constant temperature. When the addition of heat ceases the temperature falls in consequence of work done, giving a curve of adiabatic expansion. During the return, heat is withdrawn in proportion to the reduction of volume, and the curve is again isothermal. The compression is adiabatic, and in the pure Carnot cycle the gas has again returned to its original volume.

Mr. Diesel has attempted to realize, within the limitations of practice, this cycle in his engine, and in so doing has produced a motor of very high thermal efficiency. In order to accomplish this result it was evident that a much higher degree of compression was necessary than that used in existing motors, since it was demanded that the charge be compressed adiabatically to the maximum initial pressure at which the motor was to be operated, this pressure not to be exceeded by the gases generated during the combustion. Such a compression would naturally produce an increase in temperature sufficient to ignite the combustible, and hence it became apparent that the fuel must not be introduced with the air but that the air must first be compressed adiabatically and that the fuel must then be introduced and burned during the outstroke of the piston isothermally, if the desired cycle was to be practically realized.

Here a practical feature of importance appears. In all existing internal combustion motors, the question of the ignition of the charge has been one upon which much ingenuity has been expended. In the early Otto engines, a small flame was employed, acting through openings in an ingeniously constructed slide valve; the flame being blown out by each ignition and relighted from a fixed gas burner. This was followed by the invention of the incandescent tube by Daimler, and this again by the use of the electric spark, and at the present time nearly all internal combustion engines use either the hot tube or the spark ignition.

In the Diesel motor, however, the high temperature attained by the compression of the air is sufficient to provide for the ignition of the combustible, and it is only necessary for the fuel to be injected into the heated air for its ignition and combustion to take place.

In this theoretical discussion of the subject, Mr. Diesel laid down four conditions as essential to the realization of the highest economy:

First, that the combustion temperature must be attained not by the combustion, and during the same, but before, and independent of it, by the compression of pure air.

Second, that this is best accomplished by deviating from the pure Carnot cycle to the extent of combining two of the stages of the cycle, and directly compressing the air adiabatically, instead of first isothermally from 2 to 4 atmospheres, and then adiabatically to 30 or 40 fold.

Third, that the fuel be introduced gradually into the compressed air, and burned with little or no increase in temperature during the period of combustion.

Fourth, that a considerable surplus of air be present.

It will be seen from these conditions that a motor to meet them, although operating upon the so-called "four cycle" principle must differ essentially from engines of the Otto type, and it was to realize these conditions that the Diesel Motor, as presented to the committee, was designed.

The general construction of the 20 hp. motor examined by the committee resembles in design a vertical steam engine of the marine type, except that all parts are built to stand the high pressures employed. The working cycle is as follows:

On one down-stroke the main cylinder is completely filled with pure air, the next upstroke compresses this to about 35 atmospheres, creating a temperature more than sufficient to ignite the fuel. At the beginning of the next down-stroke, the fuel valve opens, and the petroleum, atomized by passing through a spool of fine wire netting, is injected during a predetermined part of the stroke into this red-hot air, resulting in combustion controlled as to pressure and temperature. This injection is made possible by the air in the starting tank, which is kept by the small air-pump at a pressure some 5 to 10 atmospheres greater than that in the main cylinder. A small quantity of this air enters with the fuel charge, which it atomizes, as described. When the motor is running at full load, a very small quantity of injected air suffices, and the pressure in the air tank steadily rises. At half load, with less fuel injected, more air passes in. For this reason, the starting tank is made large enough to equalize these differences, and a small safety valve is provided on the air-pump.

The petroleum is pumped into the fuel valve casing by a small oil-pump bolted to the base-plate. This pump is arranged to pump a fixed maximum quantity of petroleum. A by-pass is provided so that this whole quantity, or any portion of it, can be returned to the supply tank. The governor controls the action of this by-pass valve, closing it just long enough to compel the exact quantity of the fuel required to pass into the fuel valve casing. The full charge of air being always supplied for complete combustion, it matters not whether the governor permits one or fifty drops of petroleum to enter the working cylinder at each motor stroke, the combustion is always complete. To stop the motor it is only necessary to close the valve which admits the petroleum into the fuel valve casing. The valve gear consists of a series of cams placed on a shaft journaled on brackets cast on the cylinder.

The especial claims covered by the Diesel American patent are in substance: (1) The compressing of the air alone to a point producing a temperature above the igniting point of the fuel to be consumed, and then gradually introducing the fuel for combustion into the compressed air while expanding against a resistance sufficient to prevent an essential increase of temperature and pressure, then discontinuing the supply of fuel and further expanding without transfer of heat; (2) the means in combination with the general details of the motor, for opening the valve and admitting fuel at the beginning of the stroke, and of cutting it off at a predetermined part of the stroke, i. e., of governing by controlling the duration of the combustion; (3) of the combination, with the above operations, of a reservoir of compressed air for the purpose of starting the engine and of introducing the fuel.

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*Report of the Franklin Institute, through its Committee on Science and the Arts, on the invention of Rudolf Diesel, of Munich, Bavaria.

The results of tests of the Diesel motor are very harmonious, although made by several observers at distant points from each other. Thus, the test made in Germany by Professor Schroter showed an indicated thermal efficiency of 34.2 per cent. at full load, and 38.5 per cent. at half load; and an effective thermal efficiency (based on brake horse-power) of 25.7 per cent. at full load and 22.4 per cent. at half load. The tests of Professor Denton in New York showed similar results, i. e., indicated efficiency at full load, 37.2 per cent.; at half load, 41.2 per cent.; brake efficiency at full load, 25.06 per cent.; at half load, 19.09 per cent.

It has been a question as to how far these remarkable thermal efficiencies are due to the more or less complete realization of the Carnot cycle in the performance of the motor. That they are partially so is generally conceded, while Herr Diesel himself admits that a portion of the high efficiency is probably due to the completeness of the combustion. There seems to be no doubt that combustion takes place far more readily and completely in air under high pressure than at atmospheric pressure, or even at a pressure of a few atmospheres. In a Diesel motor the air is compressed to about 35 atmospheres, say 500 pounds to the square inch, and at such pressures, with an excess of air present, a sprayed liquid fuel, such as petroleum, appears to be completely burned, leaving no trace of residue. The chairman of your sub-committee was present when the lid was removed from the cylinder of a motor after it had been running almost continuously for several weeks, and there was no trace of deposit to be seen upon the cylinder walls, while the exhaust, when the motor is running, deposits no discoloration upon a sheet of white paper.

That a portion of the high economy is due to the complete combustion in a mass of highly compressed and heated air appears to be true, and this is an essential feature of the motor.

During the summer of 1900 the chairman of your sub committee had the opportunity of examining and photographing the 75 hp. motor exhibited by the Augsburg Machine Works at the Paris Exposition at Vincennes, and personally took a number of indicator cards which correspond closely with those which have been published at various times. The exhaust of this engine was entirely free from smoke or visible discharge, and did not soil a handkerchief held within a foot of the end of the exhaust pipe. He also had the opportunity of visiting the works of the Vereinigte Maschinenfabrik, Augsburg, und Maschinenbaugesellschaft Nürnberg Aktien-Gesellschaft, at Augsburg, where all the experimental work had been performed, and there had the opportunity, under the personal guidance of Herr Diesel, of examining the early models and machines and the experimental laboratory, where all the investigations have been conducted.

An interesting feature relating to the motor, and one which, in the opinion of your committee, should render it especially suitable for award, is the thoroughly scientific manner in which the whole execution has been worked up from previously conceived theoretical study. The various thermal cycles were first examined and studied, and that of Carnot was selected as conducing to the maximum thermal efficiency. The modifications in this cycle necessary to enable it to be approximately realized in practice were then studied. The various fuels available were tested, chemically and thermally, the laboratory at Augsburg containing a great number of samples, labeled with the results of chemical analysis, and the record of calorific value as found in the Junker calorimeter. The indicator diagrams obtained from the engines in actual practice agree so closely with those set out to be obtained according to the theoretical investigations, that it is, in the opinion of your committee, a noteworthy example of the true manner in which science and practice should be joined in actual work.

The chairman of your committee had the opportunity of being present, as delegate of the American Society of Mechanical Engineers, at the Mechanical Congress in Paris during the Exposition, and in the discussion of the Diesel Motor which there took place, the following points were brought out:

An internal combustion motor should have the following features realized in its action to the greatest possible extent:

(1) There should be as complete a sub-division as possible of the combustible and as thorough a mixture as practicable of it with the air.

(2) The air used in the combustion should be raised to as high a temperature as possible.

(3) All previous vaporization of the combustible should be avoided, and there should be no separation of it into light and heavy constituents.

(4) Any contact of the combustible with the more or less cold walls of the combustion chamber should be avoided.

(5) There should be no previous mixture of the combustible with more or less cold air.

(6) The combustion should be, as far as possible, independent of the velocity of propagation of the flame and the uncertainties accompanying it.

(7) The pressure should be raised as high as possible before the commencement of the combustion.

The extent to which these theoretical features have been attained in the Diesel Motor may be enumerated as follows:

(1) The sub-division of the combustible is secured by delivering it into the combustion chamber through a pulverizer employing air under a great excess of pressure, by means of which each particle is surrounded with fresh air.

(2) The preheating of the air is secured by the previous compression to a degree greater than any attained by the subsequent combustion.

(3) Any previous vaporization or gasification of the combustible is entirely avoided, the fuel being introduced cold, in its normal condition, the pulverization being entirely mechanical.

(4) No contact between the combustible and the cooler walls of the combustion chamber occurs, the fuel being injected into the midst of the previously compressed air, with which it is completely cousumed before it can come in contact with the walls. This is verified by the complete absence of any coating of carbon upon the cylinder walls, even after continuous runs of several months.

(5) There is, in the Diesel Motor, no previous mixture whatever of the combustible with air.

(6) There being no previous admixture of air and combustible, there can be no propagation of flame whatever, each particle burning of its own ignition due to the high temperature of the air with which it is in contact.

(7) The pressure is raised by the compression to a higher degree than is subsequently attained at any point in the stroke by the combustion.

At the Mechanical Congress at Paris, Herr Diesel reported that the latest trials with the motor have realized an indicated thermal efficiency of 40 per cent. under full load and 50 per cent., under half load. At the time when he first began his studies the best indicated thermal efficiency of internal combustion motors was 15 to 18 per cent., and in 1893, when his first publications appeared, the indicated efficiency had risen to 19 to 20 per cent.

At the first attempt the Diesel Motor gave an efficiency of 28 to 30 per cent., thus adding 50 per cent. at once to the best previous results, and this by the scientific application of previously-known principles.

All the members of your committee have not had an opportunity to consider the invention as described from a commercial point of view, nor do they feel sure that the high thermal effects obtained are fully utilized, as there may be losses through excessive friction between the cylinder and the crank which will neutralize some of the heat gain that is claimed. Apart from this consideration, however, those members of the committee who have not been able to study the machine so thoroughly as the chairman, join in his recommendation as expressed herewith, believing that what Mr. Diesel has done is worthy of the high commendation suggested, from the Franklin Institute.

In view of the facts as above stated, which have been verified by careful personal inspection and study by the chairman of your subcommittee of motors in the United States, France and Germany, and by his exhaustive examination of the stages of the invention in the inventor's study at Munich, and the original mechanical laboratory at Augsburg, the Franklin Institute awards the Elliott Cresson Medal to Rudolf Diesel, of Munich, Bavaria, for his improvements in internal combustion motors, and for his practical application in actual work of the fundamental principles of thermodynamics.

Dodged the Meter but was Caught.

A local electrician and proprietor of a store which furnishes electric supplies and fixtures in Madison, Wis., has been getting cheap electric lighting. His scheme was to dodge the meter. In an out-of-the-way-place back of the meter he "cut in" what is known as a "jump wire." This diverted the electric current and carried it around the meter, where the wire was again attached to the lights. By means of a button, he was able to control things so as to allow enough current to pass through the meter so that his bill would amount to something each month. His increasing economy in light aroused suspicion finally, however, and an investigation resulted in the discovery of his scheme.

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American Institute of Electrical Engineers.

The 158th meeting of the Institute will be held at the house of the American Society of Mechanical Engineers, 12 West 31st street, New York, and at the rooms of the Western Society of Engineers, Monadnock Building, Chicago, Friday evening, November 22, at 8:15 o'clock. The general subject of the meeting will be "Distribution Systems," with an introduction by President Steinmetz. The following papers will be presented:

"Distribution of Electrical Energy in Large Cities," by Mr. Louis A. Ferguson, of Chicago. The paper is based on the author's experience in Chicago, and his observations in Berlin and Milan.

"Locating Faults in Underground Distribution Systems," by Mr. Henry G. Stott, of New York.

"Alternating Current as a Factor in General Distribution of Light and Power," by Mr. Charles F. Scott, of Pittsburg.

"The Buffalo High Tension Cable Distribution System," by Mr. Harold W. Buck, of Niagara Falls.

"Notes on the Alternating Current System of Distribution." By Mr. W. S. Barstow, of New York.

"The Distribution by the Three-Phase System, and the Operation of Single-Phase Circuits by It," by Mr. W. L. R. Emmet, of Schenectady.

It is expected that other papers also specially prepared for this meeting will be presented. As the above papers will be presented in abstract only, members who are especially interested in the subject are requested to send for and read the advance copies, which will also be distributed at the meeting.

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McKinley National Memorial.

Col. Allan C. Bakewell, of 479 Fifth avenue, New York City, announces to the electrical interests of New York State that he is authorized by the New York State Organization to receive subscriptions for the McKinley National Memorial Association, and he appeals to them to assist him in raising funds necessary for the erection and maintenance at Canton, O., of a suitable memorial to our late beloved President.

Checks should be made payable to the order of James G. Cannon, treasurer.

No moneys should be paid to anyone purporting to represent Col. Bakewell, unless they are provided with satisfactory credentials from him.

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Exports of Electrical Material from New York

The following are the exports of electrical material, from the port of New York, for the week ended November 6:

Amsterdam, 1 package, $12; Antwerp, 34 packages, $2,638; Argentine Republic, 125 packages, $3,381; Barcelona, 14 packages, $500; Bremen, 3 packages, $108; British East Indies, 37 packages, $2,425; Bristol, 44 packages, $14,442; British Guiana, 52 packages, $2,930; British West Indies, 117 packages, $2,443; Brussels, 3 packages, $200; Central America, 2 packages, $90; China, 2 packages, $70; Chili, 46 packages, $2,245; Chemnitz, 1 package, $700; Copenhagen, 2 packages, $550; Cuba, 108 packages, $2,298; Dutch West Indies, 2 packages, $30; Glasgow, 90 packages, $2,769; Hamburg, 82 packages, $1,252; Havre, 16 packages, $533; Hong Kong, 73 packages, $3,489; Japan, 234 packages, $49,564; Liverpool, 6 packages, $450; London, 113 packages, $5,836; Lyons, 1 package, $150; Mexico, 121 packages, $3,451; New Castle, 29 packages, $2,500; New Zealand, 74 packages, $2,350 ; Nice, 5 packages, $200; Peru, 15 packages, $236; Philippines, 97 packages, $6,510; Southampton, 109 packages, $1,246; U. S. Colombia, 17 packages, $550; Venezuela, 3 packages, $45.

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COMMERCIAL PARAGRAPH.

The Smith & Hemenway Company and the Utica Drop Forge & Tool Company, 296 Broadway, New York City, are offering as their latest novelties in plyers a side cutting long nose plyer. The advantages claimed for this plyer are that having a long, narrow nose it will be of use in deep, narrow quarters in which an ordinary tool will not work and also will do the work of a regular tool. It is convenient to carry. Every tool is carefully tested at the factory before sending out. Can be used by telephone manufacturers, machinists, engineers, electricians and jewelers.

This company is one of the youngest and at the same time one of the foremost hardware firms of to-day, and are the publishers of one of the most unique and up-to-date catalogues, known as the Green Book of Hardware Specialties, which will be sent free to anyone on application.

In writing for same please mention the number—622.

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INCORPORATIONS.

The Pacific Electric Railway Company, Los Angeles, Cal.—to maintain 452 miles of interurban electric railway in Southern California. Capital stock, $1,000,000.

The Castile Electric Light & Power Company, Castile, N. Y. Capital stock, $800. Directors: G. S. Vangorder of Pike, M. M. Olin of Perry and J. M. Duncan of Silver Springs.

The Seaboard Company, Trenton, N. J.—to build and operate railroads and steamship lines, telephone and telegraph lines, and to deal in bonds and mortgages. Capital stock, $5,000,000. Incorporators Charles McH. Howard, Robert C. Maroney and K. K McLaren, all of Jersey City.

The California Incandescent Lamp Company, San Francisco, Cal. Capital stock, $100,000. Incorporators: F. D. Strunegham, A. J. Dibblee, N. A. Dodge, F. Gallinger and M. F. Michael.

The Sumner & Sons Company, Asheville, N. C.—to make and sell electricity in various forms. Capital stock, $50,000. Incorporators: Frank A. Sumner, Theo. Sumner, of Asheville, and A. K. Smith, of Reidsville.

The Standard Power Company, New York City—to manufacture machinery for generating power for vehicles. Capital stock, $200,000. Directors: A. F. Swan, T. S. Seeley and Thomas Howard, all of New York City.

The New Jersey and Pennsylvania Traction Company—to construct and operate trolley lines. Capital stock, $1,000,000. Incorporators: Charles M. Bates of Allentown, Pa., Lewis L. Dunham of Wilmington, Del., and Jilson J. Coleman of Trenton. The incorporators are affiliated with what is known as the Johnson Trolley Syndicate.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED NOV. 12, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

686,541. Third-Rail Safety System for Electric Railroads. Charles Schlechtiger, Nantasket, Mass., and Robert Bingham, Philadelphia, Pa. Filed March 19, 1898. Renewed Aug. 29, 1901.

686,644-686,645. Electric Railway. Lyates Woods, New York City, assignor, by mesne assignments, to the National Safety Third Rail Company. Filed Nov. 3, 1900, Feb. 1, 1901.

686,651. Trolley-Wire Hanger. George W. Gurten, Piqua, O., assignor to Augustus G. Kerns, same place. Filed March 21, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

686,812. Hanger-Board for Series Arc-Lamps. Emil O. Lundin, Boston, Mass. Filed June 10, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

686,288. Electrical Steam-Boiler. Charles E. Griffing, Hamilton, O. Filed April 2, 1900.

686,849. Electric Controller. Gordon J. Scott, Philadelphia, Pa., assignor of one-half to William S. Janney, same place. Filed Jan. 22, 1901.

686,507. Electric Meter. Jules Cauderay, Lausanne, Switzerland. Filed Sept. 17, 1900.

686,633. Time Circuit-Closer. Wilhelm Rausch, Dusseldorf, Germany. Filed Nov. 1, 1900.

TELEPHONES AND TELEPHONE APPARATUS.

686,840. Service-Meter Apparatus for Telephone-Circuits, Ernest C. Robes, Medford, Mass., assignor to the American Bell Telephone Company, Boston, Mass. Filed April 17, 1901.

686,423, Telephone Cabinet. Edwin W. Smith, St. Catherines, Canada, assignor of two-thirds to Edwin Poole and Edward Gander, same place. Filed March 21, 1901.

686,488. Telephone-Receiver. Walter F. Taylor, Brookline, Mass., assignor to the Holtzer-Cabot Electric Company. Filed April 25, 1901.

686,608. Telephone Apparatus. Edgar W. Hazazer, New York City. Filed Jan. 30, 1900.

MISCELLANEOUS.

686,245-686,246. Electrical Resistance. Josef F. Bachmann and Adolf Vogt, Vienna, Austria-Hungary, assignors to the Electric Resistance & Heating Company, Ltd., London, Eng. Original application filed Nov. 22, 1898. Divided and this application filed Dec. 12, 1899.

686,295. Liquid Interrupter for Electric Currents. John O. Heinze, Jr., Revere, Mass. Filed April 24, 1901.

686,330. Electric Transfer Apparatus. Henry H. Porter, Jr., Chicago, Ill. Filed April 1, 1901.

686,350. Strong Current Protector. Aaron A. Seeley and Charles Silet, Chicago, Ill. Filed Feb. 4, 1901.

686,395. Apparatus for Electro-Coppering Metals. Emile L. Dessolle, Levallois-Perret, France. Filed March 6, 1900.

686,402. Magnetic Separator. Thomas J. Greenway, East Adelaide, South Australia. Filed Oct. 12, 1899.

686,416. Alternate-Current Transmission. William M. Mordey, Westminster, Eng. Filed March 16, 1900.

686,419. Conduit for Electric Wires. Emmett D. Page, Brooklyn, N. Y., assignor of one-half to George A. Lutz, New York City. Filed April 2, 1901.

686,484. Distribution of Electric Currents. Engelbert Arnold, Ole S. Bragstad and Jens L. La Cour, Carlsruhe, Germany. Filed Jan. 26, 1901.

686,443. Rosette for Electric Wiring. James H. Cramphorn, Medford, Mass., assignor to Charles Sumner Knowles, New Bedford, and John Henry Parker, Cliftondale, Mass. Filed June 14, 1901.

686,459. Electric Cut-off for Emergencies. James H. Johnson, Newark, N. J., assignor of one-half to William R. Weeks, New York City. Filed April 25, 1901.

686,524. Electric Show-Case Fixture. Ernest A. Lowe, Plainfield, N. J., assignor of one-half to Charles W. Leveridge, same place. Filed July 11, 1901.

686,525. Electric Furnace. James H. Morley, Springfield, Mass. Filed June 18, 1900.

685,526 Electric Bell. John J. Mossop, Philadelphia, Pa. Filed Feb. 20, 1901.

686,561. Battery-Gauge. Charles R. Underhill, Montclair, N. J., assignor of one-half to the Varley Duplex Magnet Company, Jersey City, N. J. Filed Feb. 19, 1901.

686,583. Electric Cigar-Lighting Apparatus Cornelius J. Brosnan, Springfield, Mass. Filed Dec. 3, 1900.

686,609. Insulating Support for Electric Wires. Ralph G. Hemingray, Muncie, Ind. Filed March 11, 1901.

686,632. Apparatus for Locating Metals, Minerals Ores, etc Augustus F. McClatchy, Chicago, Ill., assignor to the Electric Metal Locating Company, same place. Filed Dec. 26, 1900.

686,679. Process of Making Storage-Battery Electrodes. Leonard Paget, New York City, assignor of one-half to Charles Coster, same place. Filed Sept. 8, 1899.

THE TELEPHONE WORLD.

Independent Telephone Companies to be Merged.

The Inter-State Independent Telephone & Telegraph Company was incorporated in New Jersey this month with an authorized capital of $3,000,000 and bond limit of $9,000,000, and the main offices in New Jersey and branches in Chicago and Aurora, Ill. The first active operations will be in the States of Iowa, Illinois, Wisconsin, Michigan and Indiana. The incorporators were men who are at the head of the Independent Telephone Company of Illinois. The board of directors and officers have not been chosen.

The purpose of the Inter-State Independent Telephone Company is the unification of the independent telephone companies of the country, beginning in Illinois and including the independent projects which are on foot in Chicago.

As the men who organized the Northwestern Telephone Company are the chief promoters of the Inter-State, into which the former will be merged, the history of the Northwestern is interesting. It is about a year old, but has 3,200 telephones in its service, and links the Fox River Valley with the Mississippi. It has 684 miles of poles and 3,600 miles of wire, covers Joliet, Aurora and Elgin with a conduit system. and has a service in half a hundred towns in its territory.

The park commissioners of Buffalo, N.Y., do not intend to let the Bell Telephone monopoly impose upon the park board, and the commissioners have held up a bill of $230 for the services of six telephones during the current year. The park board last spring notified the telephone company that no appropriation for telephone service had been made and instructed the Bell Company to remove the instruments. The telephone company allowed the telephone instruments to remain in place, expecting to have its bill indorsed by the park board without any dissension, but the commissioners did not even pay the bill any respect and declined to accept the same.

The Tunkhannock & Central Moreland, Pa., Telephone Company held a recent business meeting at Tunkhannock, at which a large amount of important business was transacted. A substantial dividend was declared, and the service of the line will be improved. Hon. H. M. Harding tendered his resignation, which was accepted. The vacancy was filled by the election of Irving Evans, of Jenks.

The Interstate Telephone Company has applied to the Clayton, N. J., borough council for permission to operate its line in the borough, offering four telephones free of charge for town use.

The Waunakee, Wis., village board has granted a franchise to the Farmers' Independent Telephone Company, which was lately incorporated for the the purpose of constructing a line from there to Middleton and also putting in a local exchange. The incorporators are Matt Schmitz, Mel. Kalscheuer, Casper Guddertz and Casper Hilgers. It was incorporated for $1,500.

The new Long Distance Telephone Company of Indianapolis, Ind., after vainly trying, for two years, to get into Elwood with its lines, has at last succeeded. The city council has granted a franchise to George W. Beers and his associates of Anderson to establish a new system in Elwood. The plant is to be in operation within four months.

President Harry Richardson of the Diamond State Telephone Company of Laurel, Del., has closed a contract with the Salisbury Telephone Company, including the connecting lines from Berlin east to Nanticoke Points west, giving him a monopoly of the telephone business of the peninsula with the exception of two small local lines.

Winnipeg, Man., will shortly have a system of public telephones for the outlying districts. The first local pay station has been established. The charge for "ordinary talk" will be five cents and may be had by inserting a nickel in the slot.

J. Y. Kirkpatrick, local manager of the Cumberland Telephone Company, will shortly begin for his company the erection of a new telephone line from Hodgenville to Lebanon by way of Athertonville and New Haven, Ky.

The Diamond State Telephone Company is completing the construction of a new line from Port Deposit, via Liberty Grove, Colora and Nottingham, to Farmington, Md., where it connects with the Elkton and Rising Sun line.

Several crews of men have been put to work building the new telephone line between South Shore and Strouseton, S. D. It is expected that the line will be completed in the near future.

The Telephone as a Burglar Alarm.

A new use has been discovered for the telephone by S. Schwarzschild of Rochester, N. Y., which, it is said, will entirely do away with the private watchman system now used to protect banks and other places, which otherwise would have no interior protection during the night after business had ceased.

The new alarm is installed by wiring the doors and windows of the store, dwelling, office, factory or other building connecting it with a device which connects by wire with a telephone.

Buttons are set in the door and window frames, or whatever point it is desired to protect, which are connected by wires and so adjusted that when the doors are closed for the night the buttons are pushed in. If a door or window is opened while the alarm is set the button is released, the electric current operates a lever at the telephone and a call is made. The operator at "central" who answers the call and receives no answer at once notifies the police.

The expense is less than it costs to patrol Rochester at night by private watchmen, who, under the present system, report but once an hour during the time they are on their rounds.

What has become a desperate struggle between the Nebraska Telephone Company, branch of the Bell Telephone Company, and the Plattsmouth Telephone Company, a branch of the Western Telephone Company, with headquarters at Chicago, is being fought to a finish at South Omaha, Neb. The Western Telephone Company, or rather the Plattsmouth Company twice asked the city council of South Omaha for a franchise to do business in that city. The judiciary committee has signified its intention to report favorably. Should the Plattsmouth Company be granted a franchise it promises to pay South Omana a royalty of 1 per cent. of its gross earnings and to give free service to all the city offices and the public schools. The company also guarantees to reduce the telephone rates at least 30 per cent. A franchise running for 10 years is asked for. The company expects to be in Council Bluffs in a short time. The next move will be to get into Omaha. This is why the Nebraska Telephone Company is making its great fight at South Omaha.

News received from Salt Lake City, Utah, states there will be no ringing for central when the new $75,000 switchboard is installed by the telephone company. The work on the installation of this switchboard will be commenced about the beginning of the new year. General Manager Murray, in discussing this matter, said that the present switchboard was but five years old, but that such an advance had been made in that time that a change is imperative. This will be the fourth switchboard since 1888, and the old one will have to be torn out and cast aside. The new one will cost, with its battery plant, $75,000. It will be operated from a central energy plant; the power will all be in the central building and there will be no batteries at the different telephones as at present. This will be a great gain in the matter of inspection, as the work will all be done in the central building.

The Hillsboro & Wonewoc Telephone Company will lease the Viroqua and Wonewoc branch of the La Crosse, Wis., and Southwestern Telephone Company's line The deal has not yet been completed, but it is understood that it will shortly be consummated. The lease will continue for three years. This will give the Hillsboro Company control of all lines in that neighborhood.

Officials of the Michigan Telephone Company have lately been in Ludington, Mich., looking over the extensive improvements made there during the summer. They will probably authorize the extension of the lines into different parts of the county. It is proposed to have two metallic circuits in operation to the more important settlements in the county before the end of the year.

A complication has arisen over the construction of the new telephone system from Richfield Springs to Jordanville, N. Y., which is intended to connect at the latter place with the Inter-state telephone line, as Highway Commissioner Wainman refuses the new enterprise a highway franchise in Jordanville where the Bell system has at present a monopoly.

For the second time within a month the Long Distance Telephone Company had its line between Manchester and Petersburg, Va., rendered almost useless by thieves stealing the wire. Starting three miles outside Manchester, the thieves stole four miles of the wire, breaking the connection with Petersburg.

The Inter-state Telephone Company is to run a telephone line from Wilmington, N. C., to Old Brunswick, where the fish factories are located.

Taxation of Missouri Telephones.

As there seems to be a general misunderstanding in the State of Missouri among the different local telephone companies as to the method employed in taxing the property owned by them, State Auditor Allen was asked for a statement concerning the taxing of these companies under the new law which was passed at the last session of the Legislature. According to the new law, telephone companies in Missouri will be assessed for taxation by the State board of equalization in the same manner as are the railroads, bridges and telegraph companies in the State.

Telephones for China.

Oriental advices received by the steamer Victoria at Tacoma, Wash., say that Baron Masahide of Tokio, has obtained from Director Sheng of the Chinese Railway a concession for the erection of telephone lines which will connect the largest cities throughout China. The preliminary arrangements contemplate that China shall furnish the funds and the Japanese the experts and material.

The farmers in the town of Bethany, N. Y., are going to combine and build a telephone line which will run from Batavia to Linden to the county house, Bethany Center and East Bethany. It will be modern in every respect. Some time ago the Bell Company was asked to extend its line over this route and the right of way was obtained for it. The Bell people promised to do so, but have never made a move. Now the farmers have decided to build it themselves. The money will be raised by subscription at once, a stock company formed, and it is hoped to have the line in operation before winter fairly sets in. O. W. Blood, W. S. Page, Henry Webster, T. A. Hart, Clinton Merritt and Henry Gay have been appointed a committee to put the deal through.

A report from Ludlow, Ky., says that the Kentucky Telephone Company, which was recently incorporated, has elected the following officers: President, J. J. Weaver; vice-president, W. J. Savage; treasurer, William R. Schelfers. Arrangements will be made later for the manufacture of telephone instruments, and a factory erected which will employ 50 men.

Col. W. S. Thomas of the Illinois Independent Telephone Company has triumphed over Col. F. L. Bills in the struggle for an independent telephone franchise in Rock Island, and the probability is he will be granted a franchise in Moline. Thus is competition to the Central Union Company practically assured.

The local and through lines of the Monterey & Warm Springs, Va., Telephone Company are ready for use, and 'phones are being placed as rapidly as possible.

The Hope Telephone Company has applied for a franchise for the construction of a telephone system at Washington, Ark.

R. J. McMahon has secured a franchise from the village council of Stephen, Minn., and is erecting a telephone system.

Robinson & Wilson of Washington, Ia., have finished their farmers' line between Crawfordsville and Washington, the county seat.

C. W. Haskell, a capitalist of Ottawa, O., is back of a plan to establish a telephone system connecting Muskogee with various other places in the Indian Territory.

A submarine cable will shortly be laid in Topeka, Kan., under the Kansas River, It will carry the wires of Topeka's new telephone exchange to North Topeka.

The Illinois Telephone Company has changed its principal office from Bluffs to Jacksonville.

TELEPHONE INCORPORATIONS.

The Brule Telephone Company, Kimball, S. D. Capital stock, $50,000. Incorporators: M. A. Willy, H. W. Heinrichs, H. S. Stuver, E. P. Ochsenreiter and C S. Blodgett.

The Wheatville Telephone Company, Caruthers, Cal. Capital stock, $5,000. Directors: F. M. Miller, H. A. Monson, W. G. Grove, J. W. Downing and H. A. Adams.

The Brown Chapel Telephone Campany of Hancock County, Ind. Directors: Eli A. Parish, L. C. Ceider and C. E. Sipe.

The Bohemia Telephone Company, Bohemia, Ore.—to construct and operate a telephone line between Cottage Grove and Bohemia. Capital stock, $5,000. Incorporators: P. J. Jennings, W. F. Murphy and J. W. Cook.

GENERAL ELECTRICAL NEWS.

Lighting.

Borden, Ind.—This town is to have an electric light plant. Prof. Borden is at the head of the movement.

Charleston, Wash.—Messrs. Todd and Calder have filed their acceptance of the ordinances recently granted them, the first for waterworks, and the latter for telephone and electric lighting

Dardanelle, Ark.—The citizens are agitating the question of an electric light plant.

Delray, Mich.—Andrew H. Green and S. G. Barnes are anxious to furnish electric lights in this place.

Fairport, N. Y.—A special election has been called for the purpose of raising $1,900 to pay the operating expenses of the electric light plant.

Galena, Ill.—It is understood that the proprietors of the Kennedy mine in Rawlins township anticipate taking steps to install an electric lighting system at their plant in the near future.

Grayling, Mich.—This place will soon be lighted by electricity. The plant will be run by water power.

Hannibal, Mo.—The city council at a recent meeting decided to purchase a new power generator for the electric light plant.

Lemoore, Cal.—This city will sell $22,000 6 per cent. 40-year electric light and waterworks bonds December 2. W. F. Holser, city clerk, can be addressed for further information in relation to same.

Lowell, Mass.—The special committee of the city council on municipal lighting recently met at the city hall and adopted a report recommending the establishment of a municipal lighting plant.

Mansfield, La.—The town council has awarded to E. J. Obern of Birmingham the contract to furnish electric lights and the waterworks for the town at $12,288. The plant will be in operation in about 90 days.

Nicholasville, Ky.——By a recent vote the electric light question was carried here by a large majority.

Sheldon, Ill.—The Sheldon Electric Light Company was recently formed with a capital of $10,000. Horace Gibson, Joseph Nagle and J. W. Watkins are the incorporators.

Skaneateles, N. Y.—At a special village election of taxpayers the question of issuing $10,000 more village bonds to add to the equipment of the municipal electric light plant was voted on and carried.

Woodbine, Ia.—A special election has been called for December 2 to vote on the granting of a franchise to the Woodbine Light & Heating Company.

Street Railways.

Augusta, Me.—Articles of association have been received by the railroad commissioners for an electric railroad to run from Berwick to South Berwick in York County. The capital stock is $20,000. Gov. John F. Hill is the heaviest stockholder.

Canastota, N. Y.—The Canastota & Morrisville Electric Road has been granted authority to construct its line from here to Morrisville.

Chicago, Ill.—This city will have the underground trolley on street-car lines in the business district.—The new Aurora, Wheaton & Chicago Electric Railway, now under construction, is to be operated by the third-rail system instead of overhead trolley.

Fairport, N. Y.—At the regular meeting of the trustees of this village Chas. A. Lux of Clyde, representing the Fairport Electric Railway, was granted a franchise by the board to operate a street surface railway.

Guthrie, Okla.—A territorial charter has been granted by Secretary Grimes to the Oklahoma & Indian Territory Electric Railway Company with the principal place of business at Norman, Okla. The capital stock is $1,500,000.

Kutztown, Pa.—The Allentown-Kutztown Electric Company, after a struggle with the borough for the past year, has at last won its right to go through this town.

Middleboro, Mass.—A new electric street railway is proposed from Middleboro to Plymouth direct to Kingston from this town, there to connect with the present Plymouth and Kingston line. The distance is about 14 miles.

Monterey, Mex.—It is now definitely arranged for the construction of a new traction line in the Federal district to be known as the "Don Toribio y Santiago Line."

New Haven, Conn.—The New Haven & Hartford Railroad Company is considering the matter of electrifying the Valley Road between Hartford and Middletown, Conn., so as to avoid the scheme of a tunnel through the Newington Mountain at a cost of $1,000,000 or more.

New York City.—At the hearing on the application of the New York & Portchester Railway for permission to construct a four-track electric road between this city and Portchester, before the State Railroad Commissioners, ex-Surrogate James M. Varnum and others testified in favor of the petition, stating that the projected railway was a great necessity. It was estimated that the new line, including equipment, will cost $3,272,500.

Onset Bay, Mass.—It has been decided to extend the trolley railway system through to Falmouth. The plan is to continue the Middleboro line from Buzzard's Bay postoffice through Monument Beach, Wenaumet Pocasset, Cataumet, North Falmouth, West Falmouth to Falmouth Village. The distance is a trifle over 14 miles, and will make the Middleboro road in all a little over 36 miles in length from Middleboro Centre to Falmouth Village.

Paris, Ky.—That the Paris electric road will be built soon is a certainty. The same company that is now constructing the interurban line between Louisville and Georgetown is behind the Paris project.

Philadelphia, Pa.—A new trolley line is to be built at Rockledge, a charter having been granted to the Huntingdon Valley Street Railway Company, the incorporators of which are I. A. Sweigard, R. J. Armore and John S. Gilbert.

Raubsville, Pa.—The new Easton & Doylestown Trolley Company will build a power house and car barn here.

Sioux Falls, S. D.—At a recent meeting of the city council it was voted unanimously to appropriate $15,000 in aid of an electric railroad from this city to Madison.

South Haven, Mich.—The South Haven & Lake Shore Railway Company will soon begin the construction of a modern electric freight and passenger line between this place to Saugatuck, 24 miles, connecting there with Grand Rapids. Extensions will also be made to Kalamazoo and across the State to Toledo, O.

Troy, N. Y.—The Troy Terminal Electric Railway was incorporated last week. It will do a freight business only, and will be run over the streets on which the large business houses are situated, and from the river docks to the railroad yards.

Western Port, Md.—The county commissioners have granted a franchise for an electric railroad to be built between here and Lonaconing, a distance of 11 miles.

Manufacturing.

Cincinnati, O.—The Bullock Electric Manufacturing Company is planning an addition to its plant in Norwood that will give it facilities for building electrical dynamos of the largest known type. The company has recently taken orders for electrical apparatus that make it necessary to build an erecting shop which, when completed, will cost in the neighborhood of $50,000.

Portland, Me.—The Crest Manufacturing Company has been organized here for the purpose of manufacturing gas, oil, steam, electric and other engines, vehicles, etc., with $50,000 capital stock. The officers are: President, Isaac H. Davis of Boston, and treasurer, Edwin D. Mellen of Cambridge, Mass.

Saco, Me.—The Munder Electric Company has been organized here to manufacture electrical appliances and supplies with a capital stock of $50,000. The president and treasurer is Charles F. Munder of Springfield, Mass.

Company Matters.

Boston, Mass.—At the annual meeting of the Massachusetts Electric Companies, November 20, stockholders will be called upon to take action on the annual report, elect five trustees for a three years' term, amend the by-laws, changing the date of the annual meeting from the third Wednesday in November to the third Wednesday in December, authorize a change in the form of certificate so that hereafter the same may be signed by the treasurer instead of president and secretary, and authorize the trustees to sell or otherwise dispose of certain shares of stock held by the trustees. The meeting is likely to be adjourned to December 18, by which time stockholders will be in receipt of the annnal report.

Dahlonega, Ga.—The North Georgia Electric Company has applied for the privilege of increasing its capital stock to a sum not exceeding $5,000,000.

Redlands, Cal.—The Woodhill-Hulse Electric Company has disposed of its business in this city to C. E. Gage.

St. Louis, Mo.—According to broker James Campbell, negotiations for the merger of the electric and gas lighting plants of this city have reached a point where it is expected the consolidation will be effected in 30 days.

Power and Transmission.

Anaconda, Mont.—One of the largest undertakings put forth in this State is the electric power plant that is being installed in Madison County by the Madison Canyon Electric Power Company, which will send electricity into this city and Pony and other points in Southern Montana. When fully completed, according to present plans, the plant will have cost in the neighborhood of $5,000,000, and it is expected to furnish power for most of Madison County besides Butte. It is reported that power from this plant will be used to run the 100-stamp mill now in course of erection at Pony.

Clyde, N. Y.—Charles A. Lux, of this place, has been in Oswego County looking over Salmon River Falls with a view to acquiring a right to it for the purpose of generating electric power.

Danielson, Conn.—It will take about six months now to complete the power plant of the People's Tramway Company located here. The water power will be furnished by the Quinbaug River, with a fall of 16 feet.

Salt Lake City, Utah.—The Consolidated Railway & Power Company of this city has found it necessary to make an extensive enlargement of its motive power plant, and will take definite steps to erect a motive power plant on the banks of the Jordan, that may cost $250,000 to $300,000 and develop from 2,500 to 3,000 hp.

San Bernardino, Cal.—The supervisors have sold to the Mentone Power Company a franchise to build an electric pole line across the county from the north of Mentone to the west county line.

Mines.

Colorado Springs, Col.—An electric plant will be installed very shortly on the May Belle claim of the Gold Exploration Company on the Lawrence town site.

Republic, Wash.—The inflow of water in the Trade Dollar Mine is so heavy that difficulty is experienced in handling it with the whim. It is thought that a steam or electric plant will have to be installed before much progress will be possible.

Automobiles.

Canon City, Col.—Work will soon be commenced on an automobile factory in this city, the details for which have been arranged. S. T. St. John & Son, and A. H. Huffnan are at the head of the enterprise.

Hartford, Conn.—The Elizabethport factory and the New York offices of the Electric Vehicle Company, have been moved to this city.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, November 18, 1901.

STREET RAILWAY STOCKS.

NAME.	Par	Last Sale.	
NEW YORK CITY.	value.	Bid.	Asked.
Bleeker Street and Fulton Ferry	100	35	37
Broadway and Seventh Avenue	100	247	252
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	168½	168⅝
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	121	121½
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	105.	106
Brooklyn City Railway	100	241½	242½
Brooklyn Rapid Transit	100	68	68⅛
Baltimore United Railways, com	50	15⅝	15⅞
do. do. do. pref	50	91	92
Buffalo Railway	100	99	101
Cleveland City Railway	100	102	102½
Cleveland Electric Railway	100	83	85
Columbus (O.) Street Railway	100	37	38
Jersey City, Hoboken and Paterson	100	19½	20½
New Orleans City Railway, com	100	29	27
do. do. do. do. pref	100	102	106
North Jersey Street Railway	100	23½	25
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	33	36
do. do. do. pref	100	85	86
St. Louis United Railways, com	100	25⅞	26
do. do. do. pref	100	79¾	80¼
United Electric of New Jersey	100	16	18
PHILADELPHIA.			
American Railways	50	40¾	41
Citizens	50	359½	360
Columbus Railway	100	46	48
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	69	67½
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23½	24
do do pref	50	64½	64¾
Dayton Traction	100	156	156½
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151½
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205½
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	97	98
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	28½	28¾
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	163	164
West End Street, com	50	91	92
do. do. do. pref	50	113	115
CHICAGO.			
City Railway	100	185	189
Lake Street Elevated	100	13	13½
North Chicago	100	190	200
Union Traction, com	100	12½	13½
do. do. pref	100	51	51⅝
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23⅛	23¼
do. do. do. pref	50	64	64½
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	47	48

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par	Last Sale.	
NEW YORK CITY.	Value.	Bid.	Asked.
Electric Boat, com	100	18	19
do do pref	100	40	49
Electric Lead Reduction	100	2⅛	2½
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	2½	3
do do pref	100	5	6
General Carriage	100	¾	⅞
General Electric	100	259¾	290
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	241	245
General Electric	100	258½	258¾
Massachusetts Electric Companies, com	100	36	36½
" " " pref	100	93½	94
Westinghouse Electric & Mfg., com	50	70	70½
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	161	161½
National Carbon, com	100	19	21
do do pref	100	82½	85½
PHILADELPHIA.			
Electric Company of America	50	5⅞	6⅛
Electric Storage Battery, com	100	57	60
do do do pref	100	57	60
General Electric Automobile	50	½	⅝
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1½
do do do pref	50	1	1½
Philadelphia Electric trust ctfs. $5 paid	25	5½	5⅝
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	92	93
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141½

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par	Last Sale.	
BOSTON.	Value.	Bid.	Asked.
American Telephone & Telegraph Company	100	157	157½
Erie Telegraph & Telephone Company	100	20½	22
New England Telephone Company		133½	134
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co.	100	106	109
Commercial Cable Company	100	175	184
Franklin Telegraph Company	100	47	55
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	120	123
Mexican Telephone Company	100	2	2⅛
New York & New Jersey Telephone Company	100	167	170
Pacific & Atlantic Telegraph	25	78	83
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		90⅛	90¼
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	115
Cumberland Telephone & Telegraph Co	50	133¼	133½
Chesapeake & Potomac Telephone Company	100	72	75
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		78	84
Hudson River Telephone Company	100	109	112
Northwestern Telephone Company, guar	50	122	126
Providence (R. I.) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Nov. 18

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1⅜	1⅝
Eddy Electric Manufacturing Company	25	8	8¼
Storey General Electric	10	9	12
Consolidated Car Heating	100	55	57
Standard Underground Cable	100	180	190
Pratt and Whitney, pref	100	84	92

STREET RAILWAY BONDS.

ALBANY.	Last Sale.	Int. Paid.
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116¼	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98¼	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent.	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116¼	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110¼	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¼	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅜@16⅝c.; Lake, 16¾@17c.; casting, 16½@16¾c.

A consolidation of the gas and electric light companies of St. Louis under the auspices of the North American Company is confidently expected.

The Mexican Telephone Company reports for September; gross earnings, $18,119; increased, $2,458; net earnings, $8,168; increased, $2,140.

The Chicago Electric Traction Company reports for the year ended October 31, 1901: Gross earnings, $90,561; operating expenses, $80,216; net earnings, $10,345.

Surplus revenue of the United States Treasury for the first four months of the current fiscal year was $27,361,000; surplus for eight months, November 1, 1900, to June 30, 1901, was $70,791,000.

A report that the Amalgamated Copper Company has disposed of a considerable amount of copper to a syndicate at little or no recession from ruling prices is neither confirmed nor denied by officials.

An official of the Union Traction Company of Philadelphia is authority for the statement that there will soon be an assessment of $5 a share on the stock, payable in two installments, and that there will be no dividend at present.

Regarding the recent activity in the stock of the Metropolitan Street Railway Company it is rumored that the company will issue $10,000,000 new stock to meet the costs of further extensions and the equipment, with electricity, of several of its horse car lines.

Friends of John D, Rockefeller deny that he is interested in an attempt to get control of the Compagnie Generale de Traction de Paris. It is asserted that George Westinghouse, Jr., has secured an option on the property and is trying to interest American capitalists in the enterprise.

A consolidation of the Newton and Boston, Wellesley and Boston, Commonwealth and Lexington and Boston Street Railway Companies has been effected under the title of the Boston Suburban Electric Railway Company with a capital of $6,000,000, equally divided between common and preferred stock.

People connected with the Manhattan Elevated Railroad of New York say there is no truth whatever in any rumors of a deal with Metropolitan. Introduction of electric power, they say, is not only expected to result in largely increased business, but a reduction in operating the present car mileage amounting to $1,100,000 per annum.

President Jacob L. Greatsinger of the Brooklyn Rapid Transit Company, in referring to the rumors that negotiations were on for the absorption of that company by the Metropolitan Street Railway Company, says: "If there were any negotiations under way, I certainly would know about them. I therefore make an unqualified and absolute denial of the report."

The American Railways Company directors, have raised the dividend rate from 4 per cent. to 5 per cent. per annum. The earnings statement laid before the board showed about $75,000 net earnings for the quarter ended September 30, 1901, or equal to 8 per cent. per annum on the $3,750,000 capital stock. This was considered to be an ample margin of surplus. The October gross earnings, already published, showed material gain. The quarterly dividend declared, 1¼ per cent. is payable December 15. Books close November 29 and reopen December 15.

The New York "News Bureau" quotes a director of the Chicago Union Traction Company as follows: "The earnings of the Union Traction Company are much larger than they were a year ago and seem to be improving constantly. They would be sufficient, I believe, to warrant the resumption of dividends on the preferred stock within a short time if it were not for the uncertainty regarding taxes and the franchise question. With these matters still unsettled, however, the stockholders ought not to expect any distribution of earnings. At any rate there will be none for some time to come."

The Boston "News Bureau" says: "The annual report of the Massachussetts Electric Companies for the year ended September 30 is expected to show net earnings of about $890,000. This income is derived: 6 per cent. on 61,230 shares of Boston and Northern Street Railway Company stock, $367,380; and 6 per cent. on 53,174 shares of Old Colony Street Railway Company stock, $319,044. The miscellaneous income includes interest returns on surplus, dividends on Newport and Fall River Street Railway Company, Hyde Park Electric Light Company and other controlled properties, which will bring the total net income of the Massachusetts Electric Companys up to $800,000. This will leave a fair margin above the $720,000 required to pay preferred stock dividends and interest charges."

A dispatch from Pittsburg says the Philadelphia Company has arranged to secure control of all of the traction properties in and around Pittsburg by a system of consolidation and absorption. The total amount involved in the deals just concluded amounts to $58,000,000. The Philadelphia Company will increase its capital stock to $36,000,000 and will have a bonded indebtedness of $22,000,000. A part of the money to be obtained by issuing the bonds will be utilized in extending and improving the properties. The Southern Traction Company, capital stock $5,000,000, is to be absorbed, and the Suburban Rapid Transit Company and several smaller concerns will also be secured. The Mellon Traction, Light and Power properties will be leased and the Philadelphia Company will pay 5 per cent. on the capital stock of the operating companies. The Pittsburg and Charleroi Street Railway Company, the Monongahela Street Railway Company and the Pittsburg and Birmingham Traction Company are other systems to be absorbed.

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EDITORIAL NOTES.

The New York Central Tunnel Problem, In spite of the fact that the New York Central Railroad Company has a gang of men at work altering the much talked of tunnel through which trains run out of this city, with a view to improving the ventilation, a bill has been introduced into the New York Municipal Assembly to compel the substitution of electricity as a motive power in lieu of steam. As to whether the authorities have the power to compel the New York Central to change its motive power within the city limits, Mr. Everett P. Wheeler, a prominent attorney, is reported as saying:

"I am very clear as to the matter of law that the company is subject to the direction of the Municipal Assembly in regard to the motive power in the tunnel. The road was granted authority to build the tunnel by the agreement with the city in 1832. Section 2 of that agreement reads, in part:

"'And be it further ordered that if at any time after the construction of the aforesaid railways, it shall appear to the mayor, aldermen and commonalty of the City of New York that the said railways shall constitute an obstruction or impediment to the future regulation of the city or the ordinary use of any street or avenue (of which the mayor, aldermen and commonalty shall be the sole judges) the railroad company, or the directors thereof, shall provide a remedy, satisfactory to the said mayor, aldermen and commonalty,' etc.

"Then, in regard to the motive power, it is agreed in Section 3: 'That the right of regulating the description of power to be used in propelling carriages on or along said railways, and the speed of the same, as well as all other power reserved to the said mayor, aldermen and commonalty by the act of incorporation of the said company, or any part thereof, be, and the same are hereby expressly retained and reserved.'"

Mr. Wheeler refers to the practicability of the proposed change as follows:

"After consultation with eminent engineers and electricians I am absolutely satisfied that it is feasible to make through connections between the local trains of the New York Central system and the subway, which is under rapid course of building. It would not be difficult to equip with electricity cars that would carry the passengers to the end of the subway system from Stamford, White Plains, and Yonkers. It would not be awkward for the New York Central to equip all its local traffic with electricity. There would then be no need of a change of power in landing the passengers at the down town stations.

"The Grand Central Depot would continue to be used for the trunk-line business, and all baggage could be sent there, so that it would continue to be the central distributing point. This would involve making a sub-station under the car shed east of the main building—a sort of subterranean story. It is not a difficult engineering feat at all. The shed is of steel and not of masonry. It could continue to be used while the subterranean station was being excavated.

"The middle tunnel would continue to be used by the New York Central for its express trains with steam engines. The real nuisance is on the side tunnels. Electricity will have to be used there. But I think the time will come when every train coming into New York City will stop at the Harlem River to be drawn into the city by electricity."

If the Municipal Assembly orders the change work will have to be begun by the railroad company within thirty days and would probably be completed in about two years. The talked of alterations would unquestionably be heartily indorsed by the army of commuters that are now compelled to use the tunnel daily, and would in the end undoubtedly prove vastly beneficial to the road itself.

* * *

Pacific Cable Contract Let. A bill will be introduced early in the coming Congress authorizing the Postmaster General to enter into a contract with private persons or a corporation for the construction of a cable from San Francisco to Manila by way of Honolulu and Guam. It will be essentially the same bill which was reported from the House Committee on Interstate and Foreign Commerce in the last Congress.

It is understood that no special legislation by Congress is necessary to enable a private concern to lay a Pacific cable on its own account. The State Department, it is asserted, has ample authority to grant a permit for landing the cable. It is probably in view of this fact that the Commercial Pacific Cable Company, recently organized in New York with Mr. John W. Mackay as president, has awarded the contract for the manufacture and laying of the first section from San Francisco to Honolulu to an English Company. The price agreed upon is said to be in the neighborhood of $3,000,000. A director of the cable company, referring to the subject, stated recently that while the Government had not as yet granted the company permission to lay a line to the Philippines, it was confidently expected that such authority would be given them by Congress shortly after it assembles. On August 23 President John W. Mackay, who is now in California, made application to the Washington authorities for landing rights in California, in the Hawaiian Islands, and in the Philippine Islands. At that time Mr. Mackay said that since his company asked for no subsidy or guarantee, he believed there would be no trouble in agreeing with the Government on the terms and conditions upon which the cable would be landed. He said that he expected the first section would be in operation within nine months.

It is to be hoped that such will be the case, for it is generally agreed that a cable to connect the Western coast of the United States with the possessions in the Pacific Ocean and Far East is a matter of vital and immediate importance.

* * *

The Hackney Lighting and Destructor Plant.

Considerable has been said in these columns from time to time regarding destructor plants in England, and especially that at Shoreditch, located in a vestry of London, which furnishes power for lighting and other purposes. We now hear of another undertaking of like nature located in the Hackney district, which borders on that of Shoreditch.

The Hackney system is a low pressure, continuous current three-wire supply, with 240 volts at consumers' terminals for lighting and 480 for motors. The whole of the works, as planned, are not yet complete; when they are the cost will have been over $1,425,000. The refuse destructor plant is to consist of twelve furnace cells, capable of burning 160 tons of refuse in 24 hours. Arrangements have been made for the automatic handling of refuse so far as this is possible, from the moment it is tipped at the works to the time when it emerges from the furnaces as clinker. The refuse is burnt at a high temperature with the assistance of a powerful fan blast, and the residuum leaves the furnaces at a temperature of 2,000° Fahr. The works site has a frontage on the River Lea, and there are economical facilities for the supply of fuel and the shipment of the clinker material. The buildings will afford accommodation for a generating plant of 6,000 hp., but the land available will enable that capacity to be doubled later on as required. Coal will be taken from barges by an electric crane and delivered to the conveyor through an automatic weighing machine, and thence to the store. Of the six Babcock boilers, three are arranged to utilize the heat of the destructor gases. The others are placed in the permanent boiler house, and are equipped with mechanical chain grate stokers, water purifiers and superheaters.

There are at present two high-speed triple expansion engines of 1,000 hp. each, driving 600 kw. direct current generators. There are also two 500 hp. engines with 300 kw. dynamos. A special feature of the central switchboard is that the generator panels are in front, and the feeder panels at the back of the board, an arrangement which combines compactness with simplicity in working. There is a battery of Tudor accumulators (2,800 ampere hours' capacity), which will store for future use the energy developed in the destructor at times when it would otherwise be wasted.

Supply mains have been laid in 25 miles of streets, and they are of the British Insulated Wire Company's triple concentric type throughout, with paper insulation and lead-covered. They are laid in stoneware and iron troughs, filled in solid with a bituminous compound. Three hundred and twenty 2,000 cp. arc lamps were supplied for lighting 9 miles of streets. The charges to the public for energy, are: private lighting 8 cents per unit; for motive power 4 cents per unit. There is a meter rent of 25 cents per quarter, where the demand does not exceed the equivalent of twenty-five 8 cp. lamps, and 50 cents where the demand exceeds the limit. A "free" wiring arrangement entered into between the Council and the National Electric "Free" Wiring Company will go a long way toward inclining the residents in such a district as Hackney—with so many low rental residences—toward changing from gas to electric lighting. The company provides and fixes everything for a rental of 11 cents per lamp per quarter for any lamp up to 50 cp. The householder has the option of purchasing the wires and fittings by paying the original cost price, plus 25 per cent., within 18 months from the date of connection and at any time after the first 18 months at original cost price, plus 20 per cent., less a deduction of 1½ per cent. for every year the installation has been in use. This system of charging disposes of many difficulties which are bound to arise where the old "free" wiring methods are adopted.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

A test of the submarine boat Fulton was made in Peconic Bay last Saturday night and Sunday, with a view to ascertaining how long a boat of this description could remain under water. It was demonstrated that it is possible for men to breathe and work unhindered at a considerable depth for almost an indefinite time. During the fifteen hours the Fulton rested on the bottom of the Bay not an inch of the compressed air taken below by the crew was used, the air in the vessel itself furnishing all the oxygen needed. In the boat were Rear Admiral John Lowe, U.S.N. (retired); Lieut. Arthur MacArthur, in command of the torpedo boat Winslow; Capt. Cable, of the Holland Torpedo Boat Company, and five employes of the works at New Suffolk, where the test was made. In speaking of the test and what it showed in naval methods, Rear Admiral Lowe said: "The Fulton has shown what could be done in case of need in actual warfare in many instances. Suppose she had made an attack upon a hostile fleet, had discharged all of her torpedoes and been discovered. She is absolutely without means of defense except her powers of disappearance. She might be surrounded and pursued so closely that it would be dangerous to attempt to run away, even under water. In that case she need only drop quietly to the bottom and rest there, without noise or effort or anything to betray her presence. She can remain there for four or five days, and in case of emergency, if the food holds out, for a week. Her escape then would be almost certain. In another case, for repairing machinery, shifting torpedoes or anything else which requires stopping the engines, or quiet, she could find a secure dock at any time on the bottom, except in very deep water. Her speed is not great, only nine knots on the surface, and seven knots when running submerged, but to my mind the time has gone by when speed is the first requisite of a torpedo boat. The battles of the Spanish war showed that they cannot hope to get within striking distance after they have been sighted. It was an advantage before the perfection of the heavy caliber rapid fire guns. The torpedo attack of the future must depend not upon speed, but upon concealment, either by darkness or by water."

◆

The 158th meeting of the American Institute of Electrical Engineers was held at 12 West 31st street, New York City, Friday, November 22, President Steinmetz in the chair, two hundred members and guests being present. The general subject of the evening was "Methods of Distribution," upon which papers were presented by Messrs. Louis A. Ferguson, of Chicago, Henry G. Stott of New York, Harold W. Buck of Niagara Falls, Charles F. Scott of Pittsburg, W. S. Barstow of New York, W. L. R. Emmet of Schenectady, William Lispenard Robb of Hartford, and Philippo Torchio of New York. The subject and papers were discussed by Messrs. Steinmetz, Dunn, Williams, Burnett, Henshaw and J. W. Lieb, Jr.

◆

Six new electric stages, each capable of seating seventeen passengers, will be started in Fifth avenue by the New York Electric Vehicle Transportation Company to-day. Two more electric stages and two double decker stages will be put into service a few days later. It is the intention of the company to run the electric vehicles on a schedule of ten minutes' headway. Each of them will make 80 miles a day. The present horse stages will be continued without change until the line is fully equipped.

◆

The Examiner of Interferences in the Patent Office at Washington handed down an opinion last week in the case of Charles E. Tripler, of New York, against Prof. Carl Linde of Munich, Germany, awarding priority of invention to Prof. Linde for the self-intensifying process of making liquid air. Professor Linde announced in 1895 that he had discovered a practical method of making liquid air in large quantities and at comparatively little expense, and after applying for a patent in this country and several foreign countries, he disclosed in scientific publications the full details of his process. Mr. Tripler filed an application for a patent on a similar invention in 1897, and asserted that he discovered it in 1891. A company was formed and large amounts of stock were disposed of.

◆

Incidental to the use of electricity as a motive power on the elevated road in this city, the Manhattan Railway Company will erect a one-story frame building on part of the block bounded by Second and Third avenues, 66th and 67th streets, which will be used as a school for motormen. The establishment will be similar to the one maintained by the Metropolitan Street Railway Company, containing "skeleton cars," by means of which green hands may be made thoroughly familiar with all the working parts. The Manhattan's building will cost $3,000.

◆

Work has been commenced on a wireless telegraph system to be tried between Ludington and Manistee, Mich.

◆

The heating of ironing machines by electricity in place of steam, gas and gasoline, as heretofore, is now being used in a laundry in Kansas City, Mo. Its advantage can be made apparent to all by the simple statement that the little machine has a capacity of 72,000 collars and cuffs in twenty-four hours. The machine is driven by an electric motor attached near the base. The heating of the ironing roll is accomplished by stationary heating coils placed within them. Electric heating has the advantage of being more uniform than any other, it is very intense, and can be regulated to a nicety by a finely subdivided switchboard. It is asserted that the character of the electric heat renders it more desirable for starched goods than steam or gas.

◆

The Rapid Transit Subway Construction Company of this city has purchased another site for a sub-power station, which is at 110 and 112 East 19th street. The building will cost between $60,000 and $70,000 and will be only used as a transformer station.

◆

A method of quickly preparing wood for building and manufacturing purposes by electricity is being tried in Austria. The process is simple. The green wood is placed in a large wooden trough, whose bottom is covered with a lead plate, which is connected with the positive pole of an electric battery. A second lead plate covers the wood to be dried, thus forming the negative pole. The wood is then subjected to a bath in a solution composed of 10 per cent. resin and 75 per cent. soda, and under the influence of the electric current the sap is drawn out of the wood and rises to the surface, the solution being absorbed by the wood. In about two weeks' time after this the wood is dry and ready for use, or the drying can be done by artificial means in a much shorter time. The actual operation in the trough, however, only occupies from five to eight hours.

◆

In Europe experiments with automobiles for military purposes are being carried on extensively.

◆

Officials of the Eastern Extension Telegraph Company recently came upon an interesting cable fault in their Sydney-Nelson section, which is laid in 330 fathoms of water. The cable had become interrupted, and when the cable electricians went to take out the fault and discover its cause they found what is supposed to be a shark's tooth firmly fixed in the core of the cable, notwithstanding that it was protected by the usual iron wire and other sheathing.

◆

It is sometimes useful, says the "Shipping World," to be able to convert units that are employed in one branch of engineering into those used in another branch, without long calculations. The watt, for instance, is known to those using electricity as the unit of power, or of energy consumed or converted. It is also known as 1-746th of a horse power. But it is more convenient if we know that it equals the mechanical energy represented by 44.24 foot pounds. That is to say, one ampere of current moving under the influence of one volt pressure, or any combination of volts and amperes and that will make unity when multiplied together, is the equivalent, in the expenditure of energy to the work a man would do in lifting one pound 44.24 feet high, or any work, any weight raised any distance, in which the weight and the distance multiplied together make 44.24.

◆

Messrs. Dybowski and Frow have just concluded some preliminary experiments to ascertain the yield and quality of the gutta-percha obtained from a peculiar, Chinese plant known as "Tu-Chung," live specimens of which are at present growing in several botanic gardens in Paris and at Kew, says the London "Electrical Engineer." The elastic gum produced by the plant is said to be of the nature of gutta-percha rather than caoutchouc, which is a kind of india-rubber; and the vessels containing it are much more similar to the cells which yield true gutta-percha than to the laticiferous vessels of the common-rubber yielding trees. The plant which Messrs. Dybowski and Frow had at their disposal was only very young, and although the bark was found to be full of laticiferous vessels, it was not considered advisable to remove any branches for examination. The dried leaves yielded 2.25 per cent. of substance soluble in toluene, which, considering that the fresh leaves contained 70 per cent. of moisture is not a high return. The fruits, however, gave a much better result, as when undried, containing 7.4 per cent. of moisture, they yielded over 27 per cent. of substance soluble in toluene. The product obtained was of brown color, and behaved exactly like gutta-percha. When immersed in hot water it softened, and could then be stretched out into thin sheets, like gold-beater's skin, or moulded, while on cooling it again became quite hard. As gutta-percha it was stated by experts to be of good quality.

AN ELECTRIC TRACK SWEEPER AND WATERING CAR.*

The introduction of electric working on tramways is calling into existence various auxiliary apparatus which is of very considerable importance in the efficient operation of a tramway system. One need hardly point out that there are distinct advantages in keeping the track and the rails clean, and in this connection the advantages of a track sweeper car and a watering car are now being recognized by tramway managers, a number of lines in England being already equipped with them. It is sometimes desirable to employ a car which can be utilized both for watering and sweeping, and there are no special difficulties in designing such a car.

From a sanitary point of view, the development of an electrical watering car is of considerable importance, because it would be easy to combine with it special watering apparatus by which the entire roadway could be cleansed very much more efficiently and quickly than by the antiquated water barrel.

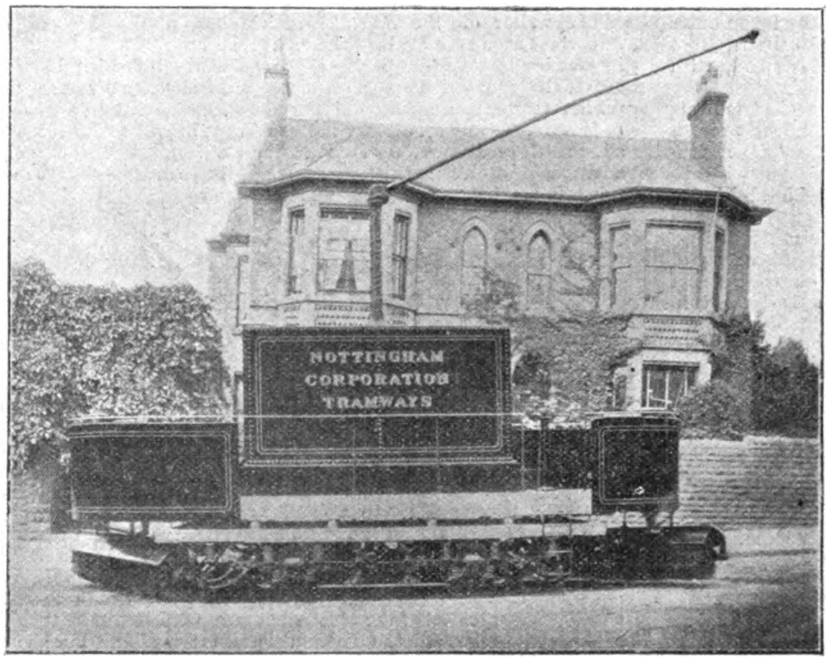

Fig. 1.—Track Sweeper and Watering Car.

In America, a good deal of street sweeping and watering is carried out by specially designed electrical cars, and with the extension of tramways in this country it is obvious that the advantages of this system will become generally accepted.

Here are reproduced two interesting examples of track sweepers and watering cars, which have been supplied to the corporations of Nottingham and Bolton.

Fig. 1 illustrates a combined track sweeper and watering car, built from the design of Mr. Arthur Brown, borough engineer of Nottingham, and consists of a tank and accessories, mounted on an ordinary car truck. The floor framing is built of well seasoned pitch-pine and oak, the side sills being extended the whole length of the frame to provide a platform at each end. There are fixed at each end of the car series parallel controllers, the equipments as regards motors and trolleys being of the same standard pattern as obtains on ordinary cars. Each car carries two revolving brushes, which are placed at each end, and are arranged to revolve in either direction. Gear is provided on each platform by which the brushes can be lifted off the track. The brushes are driven by a chain wheel attached to the axle of the driving wheel. Only one brush is in operation at one time, a clutch being provided by which either of the brushes may be put out of action. In order to give sufficient and convenient access to both the brush-driving gear and the bearings, trap doors are provided on the platform. At the end of each platform are dashes composed of steel sheet supported by wrought-iron rails and standards. The water tank is composed of ¼ inch iron plates, and has a total capacity of 500 gallons. For cleansing the groove in the rails a small pipe of ¼ inch bore is placed on either side of the tank, and the water-jet, playing directly over the rail, effectually removes any accumulation of dirt. Valves for controlling the water pipes are provided on each platform.

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*From the "Electrical Review," London.

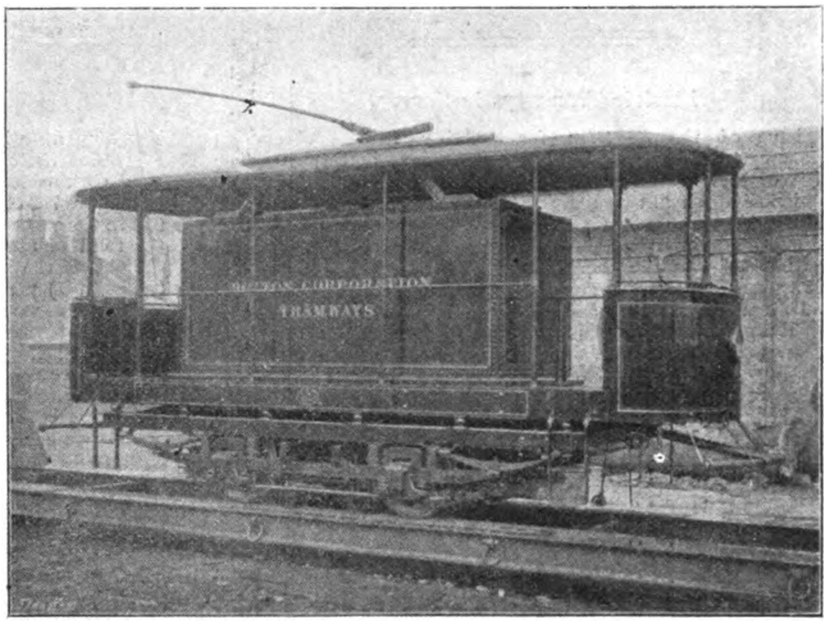

FIG. 2.—WATERING CAR.

Fig. 2 illustrates the type of watering car supplied to the Bolton Corporation Tramways, the tank in this case being considerably larger, and capable of holding 1,500 gallons. It also differs from the former car, in that a canopy roof is arranged to cover the whole of the floor frame, which, in addition to providing some protection against inclement weather, forms a suitable foundation for the attachment of the trolley base. This type is also provided with a small water pipe and brushes for cleaning the grooves.

USES OF ELECTRICITY IN COAL MINING.

BY W. GILBERT IRWIN.

The introduction of the products of modern industrial science to the process of coal mining marked the beginning of a new era in the evolution of this important fuel industry. For many years numerous processes looking toward economy have been applied to the coal mining industry as practiced in continental Europe, and the operators of England have been following in the paths laid down by the more conservative concerns on the continent. The limited coal areas of Europe have been responsible for the introduction of these modern economic ideas, and also for the application of the more advanced ideas in mine engineering. For many years but little attention was paid by American coal operators to the matter of economy, owing to the vast extent of our coal areas, but of late more correct mining methods are practiced and the mines in this country are being equipped with the most approved operating machinery. This latter innovation has been brought about through the unusual demand for all kinds of coal.

The rapid development of electricity and electrical machinery in this country has brought about the extensive employment of this modern agent in the different processes of mining and handling coal. To-day electric lighting even to the workings, electric haulage and electric power for mining machinery is in wide use in the coal fields of this country. Electricity is also in wide use in tipple operation and for many other purposes, both inside and outside of coal mines. Electric lighting has been in use in the anthracite coal fields for some years, and was introduced in the Connellsville coking field a dozen years ago. This agent has in a large degree done away with the necessity of miners' lamps and thus eradicated one of the frequent causes of mine explosions. While electric lighting for coal mining purposes has not yet been brought to that degree of perfection desired yet it has already been pretty thoroughly demonstrated just what it is destined to accomplish. This agent is now in almost general use in the main entries in the Pittsburg coal field and in many cases even in the workings, and the same may be said of the soft coal fields of Ohio, West Virginia and Maryland.

There are a number of well-known types of electrical mining machines in use in the United States to-day. Machines of both the chain cutter and the puncher types operated by electricity are now in use in many of the mines of Western Pennsylvania and their success is no longer a matter of uncertainty. There are nearly a dozen American concerns now engaged in manufacturing coal mining machines and the keen competition in the business has been responsible for some notable improvements in this class of machinery. For the adjustment of mining scales and computing wages it is estimated that the average electrical power driven mining machine will do the work of twelve men. With one of these machines it is possible to cut from 50 to 100 feet of entry per day. Power for the operation is either furnished from the electric power plant at the mouth of the mine direct or indirect. In many cases the motor is of the multipolar type, having iron clad armatures and two field coils well protected from injury by the frame of the machine.

There was a time not so long ago when electric haulage in coal mines was not considered any too safe, especially in low veins. The current wires which carry the current into the mine are charged with from 250 to 500 volts and great care must be exercised by the men in order to avert accidents. The introduction of electric haulage has reduced the cost of bringing the coal out of the mine to less than five cents per ton and at the same time this new system has increased the output five times over the old mule system of haulage. Among the modern electrically equipped mines in Western Pennsylvania may be mentioned the mines of the Berwind-White Coal Mining Company at Windber, the Soldier Run mines of the Jefferson and Clearfield Coal & Iron Company near Reynoldsville, the new Hazel Mine of the Pittsburg and Buffalo Company in Washington County, and the new mines of the Ellsworth Company in Washington County. Each of these mines are equipped for the mining of something like 5,000 tons of coal daily, which illustrates rather forcibly the achievements of electricity in the coal mining industry. Many of the older mines in the various coal fields have been changed and modern electric power plants installed in order to compete with later and more modernly equipped mines. All the mines opened during the past three or four years are equipped with electric power plants.

Through the manipulation of the tipple by electricity another considerable item of expense is removed. The switches, dumping apparatus, screens, and machinery for loading on the railroad cars are all operated by electricity, and the same agent furnishes the power for operating the mine fans and the pumps which carrry the water from the mine. In the coking fields electricity has displaced the old larry systems for charging the ovens and is used to operate the automatic coke drawing machines. In by-product coke making electricity does a great variety of work and as this industry becomes more generally introduced into the fields of this country the uses of electricity will be increased. All the large electrical manufacturers now devote much attention to the manufacture of motors, dynamos and other electrical machinery especially adapted to the uses of coal mining and the possibilities along this line are constantly increasing.

Emperor William Has His Way.

A dispatch from Berlin, Germany, says that the committee of the municipality appointed to deal with the Unter den Linden controversy between the Emperor and the municipality has capitulated, and adopted, by a vote of 9 to 2, the Government's plans for the projected alterations. The plan of Emperor William was to have the proposed electric connecting road across Unter den Linden pass underneath that thoroughfare. The municipality planned to have the electric road pass over the thoroughfare.

PRINCIPLES OF DYNAMO CONSTRUCTION.—III

(Written for ELECTRICITY.)

Hopkinson's Formula.

The point of vital interest in the design of a magnetic circuit is the exact number of ampere-turns required for a working magnetic field.

Hopkinson's formula is more rigorously true, and, in general, more logically apparent as an exact means of calculation for iron circuits than any other existing method. The different qualities of iron of which a circuit is apt to be composed offer no obstacles to its application. Cast-iron pole-pieces, wrought-iron magnet cores, and a cast-iron keeper, of which many dynamos have been and are being constructed, are cases only successfully treated by an analytical method.

First Approximation.—Hopkinson bases his calculations upon certain premises that are necessary and strictly admissible in this case.

(1) He assumes that the distribution of magnetism in the cores is equal and regular, also in the armature and air gap.

(2) The lines of force of the pole-pieces pass into the armature.

(3) The reactory effect of the armature is neglected and therefore the total magnetic force acts as one.

A system involving the use of curves is now almost wholly in vogue; an outline of the same is given below with the characters corresponding.

If I = total induction through the armature,

A_1 = the area of a section through the amature,

A_2 = the area of the air gap,

A_3 = the area of the core of magnet,

then the specific induction of each part could be represented as follows:

$$\frac{\text{Total induction in armature}}{\text{Total cross section of armature}} = \frac{I}{A_1}$$

$$\frac{\text{Total induction in air gap}}{\text{Total area of air gap}} = \frac{Ig}{A_2}$$

$$\frac{\text{Total induction in magnet core}}{\text{Total cross section of magnet core}} = \frac{Im}{A_3}$$

where Ig = induction in gap and Im = induction in magnet core.

In the curve, Fig. 10, the ampere turns corresponding to any specific induction are readily found. For instance if the lines of force I in the armature are 1,000,000 and there are 100 sq. cm., of core, dividing 1,000,000 by 100 gives 10,000 lines of force per sq. cm. Taking Fig. 10 and placing the finger on 10 and following the line horizontally until the curve is reached and directing the eye down to the base line reading "magnetizing force in ampere turns," the ampere turns obtained are about 6. This means that every centimeter of armature iron in the length of the magnetic circuit requires 6 ampere turns to magnetize it up to 10,000 lines of force per square centimeter.

Fig. 10, to which reference has already been made, fully illustrates the internal action going on in a sample of wrought-iron. Aside from this fact it serves as an excellent reference when a portion of the magnetic circuit composed of wrought-iron is to be considered.

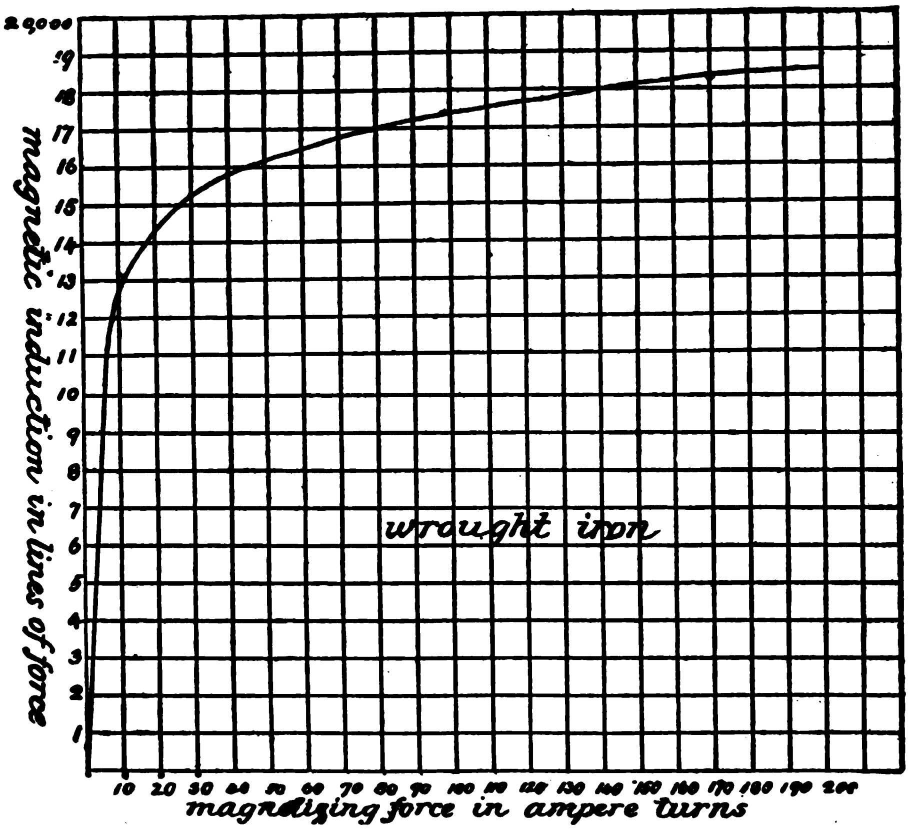

FIG. 10.

Grades of good wrought-iron do not differ so greatly in permeability as to force us to disregard data concerning other samples. On the contrary, they serve as the best possible assistance and enable the engineer to arrive at conclusions which otherwise would be perfectly indefinite without their use. Any piece of wrought-iron of fairly good quality can have its magnetic output very approximately predetermined by the above. As an illustration: A wrought iron ring of one centimeter cross section (see Fig. 11), and 35 centimeters length is divided into four parts, how many ampere turns will be required to produce a field of 15,000 lines of force? There are four air gaps of equal length and cross section and a similar number of segments of wrought-iron to be considered.

By referring to the curve $\frac{B}{A}$ = 15,000

= 27 amp. turns.

Therefore each cm. of iron requires 27 ampere turns or a sum total of 35 × 27 = 945 A.T. for the reluctance of the iron.

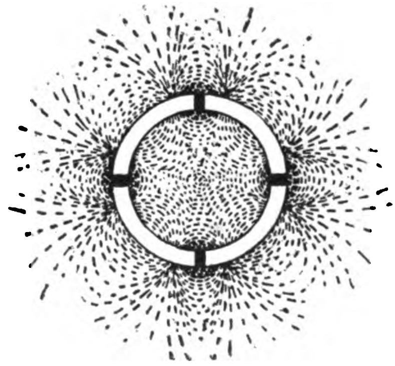

FIG. 11.

As regards the air gaps, each gap is 1 sq. cm. by ½ cm. long. Referring to the formula already given

$$\text{Ampere turns} = .8\,B\,\frac{l}{q}$$

$$= .8 \times 15{,}000 \times \frac{2}{1} = 24{,}000.$$

This last number of ampere turns must be added to those required to overcome the magnetic reluctance of the iron, thus giving a sum total of 24,945 ampere turns.

The magnetic circuit of a dynamo differs in no respect from the example cited. We have a circuit composed of parts of different permeabilities; wrought-iron, air, and possibly cast-iron or steel. The system to be followed is identical in both cases, certain allowances being necessarily made, which will be treated of later.

The table below, the result of Hopkinson's investigations, clearly shows the magnetic properties of cast and wrought-iron:

HOPKINSON'S OBSERVATIONS.

Annealed Wrought-Iron.			Grey Cast-Iron.		
B	H	μ	B	H	μ
5,000	1.66	3,000	4,000	5.	800
9,000	4	2,250	5,000	10.	500
10,000	5	2,000	6,000	21.5	279
11,000	6.5	1,692	7,000	42.	133
12,000	8.5	1,412	8,000	80.	100
13,000	12.	1,083	9,000	127.	71
14,000	17.	823	10,000	188.	53
15,000	28.5	526	11,000	292.	37
16,000	52.	308	....	....	..
17,000	105.	161	....	....	..
18,000	200.	90	....	....	..
19,000	350.	54	....	....	..
20,000	666.	30	....	....	..

As $H \times \mu = B$, the column B is obtained by such multiplication or H can be discovered by dividing B by μ, etc.

CALCULATION OF μ.

Silvanus Thompson gives a very useful formula, verified by this table, for wrought-iron as follows: If the flux be between 7,000 and 16,000 lines of force per sq. cm. μ can be calculated by the formula.

$$\mu = \frac{17{,}000 - B}{3.5}$$

This is only true for annealed wrought-iron. As an example, if the permeability at 10,000 lines of force be desired, then,

$$\mu = \frac{17{,}000 - 10{,}000}{3.5}$$

= 2,000, which by comparison with the table is found to be correct.

A table of more immediate benefit has been drawn up, showing the ampere turns per cm. and inch length of wrought-iron at different specific inductions:

WROUGHT-IRON.

Per Centimeter Length.		Per Inch Length.	
A. T.	B.	A. T.	B.
200	18,500	500	115,625
190	450	475	115,313
180	300	450	114,375
170	250	425	114,063
160	200	400	113,750
150	150	375	113.438
140	100	350	113,125
130	17,800	325	111.250
120	600	300	110,000
110	500	275	109,375
100	300	250	108.125
90	200	225	107,500
80	17,000	200	106,250
70	16,700	175	104,375
60	550	150	103,438
50	200	125	101,250
40	15,800	100	98,750
30	200	75	95,000
20	14,300	50	89,375
10	12,600	25	78,750

The English system is a little more than the French, that is, the use of the inch instead of the centimeter, although familiarity with both is advisable.

The table of ampere turns for each inch length of wrought-iron at various inductions per square inch is very useful in practical design.

DIAMETER OF WIRE.

Calculations for the right size of wire on a coil have been given in different formulæ with the stipulation that certain conditions be preserved.

(1st.) The iron core is far from saturation, which is imperative in the construction of dynamos. In such a case the strength of field may be expressed in ampere turns, and, given a certain required strength in ampere turns and a given difference of potential between the ends of the coil, the diameter of the wire may be calculated as follows:

Let $T =$ ampere turns required.
$E =$ difference of potential in volts between the ends of the coil.
$n =$ number of turns on magnet.
$r =$ resistance of coil in ohms.
$C =$ current in amperes.
$x =$ the length of a mean convolution in inches.
$d =$ diameter of wire in mils.

(Note.) A mil is equal to .001 of an inch.

We may take as a standard that a wire 1 mil in diameter, and of 96 % pure copper, 1.106 inches measures 1 ohm. Then the resistance of any wire will be

$$\frac{\text{Length in inches}}{1.106\, d^2} \qquad (1)$$

from the conditions we have

$$T = \frac{E\, n}{r} = C\, n \qquad \frac{n}{r} = \frac{T}{E}\ \text{constant} \qquad (2)$$

$$r = \frac{x\, n}{1.106\, d^2} \qquad d = \sqrt{\frac{x\, n}{1.106\, r}}$$

by equation (2) $\frac{n}{r} = \frac{T}{E} \therefore d \quad \sqrt{\frac{x\, T}{1.106\, E}} \qquad (3)$

Having found the diameter, it is obvious that if E is constant, as we are assuming it to be, T will also be constant, whatever n may be, for r varies with n, and C varies inversely as r by Ohm's law. It is, however, necessary to make n sufficiently large so as to avoid overheating. This is readily calculated from the formula—

$d = 32\, \sqrt{C}$, whence $C = \left(\frac{d}{32}\right)^2$ being the maximum current which should be used on the stationary coils of dynamos to avoid wasteful heating. The wire should be coiled on until

$$r \quad \frac{E}{\left(\frac{d}{32}\right)^2}$$

As an illustration, let us suppose it to be necessary to find the diameter of the wire on a coil of 10,000 *A. T.* and 110 volts difference of potential between ends, and the mean length of each turn 10″:

$T = 10{,}000.$

$E = 110. \qquad d = \sqrt{\frac{10 \times 10{,}000}{1.106 \times 110}} = 29$ mils.

x [illegible] nches.

We can now apply the limiting formula for the value of the current in terms of the diameter. If this seems incompatible with the size of the wire another adjustment of parts will be necessary in order to obtain the proper relationship.

Applying the formula $C = \left(\frac{d}{32}\right)^2$ to the data on

hand we find $\qquad C = \left(\frac{29}{32}\right)^2 = 9$ amperes.

A wire having a diameter of .029 of an inch has a cross section of about 850 circular mils, and this sized wire according to the results of actual practice is proper for the current it is supposed to carry.

Under ordinary conditions, the coil not being wound too deeply, a warmth of about blood heat is obtained if a figure of 1,000 circular mils per ampere be allowed. If a minimum of 700 cm. be employed, the safety limit, though small, will be sufficient to prevent the overheating of coils of small depth, though it is best and strictly desirable to allow a figure of 800 to 1,000 C.M. per ampere in the generality of cases.

The determination of the correct number of circular mils to allow in different specific cases is almost arbitrarily settled. So much depends upon the depth of the coil, that it may almost be said that the current density in all cases is strictly proportional to the radiating power or ventilation of the coil. Armature windings are different in this respect from field coils. Their rapid rotation and almost constant circulation of air, naturally allows the safety factor to be considerably lower than in field coils. But even here there are factors that tend to modify the expected results. Stranded wire on armatures possesses a much higher radiating power than would be at first supposed, and this combined with other fortuitous conditions might lower the circular mils for large armatures to a point never to be thought of for magnet coils; but this will be more fully treated in another department of this subject.

Some Economies of Forced Draught.

One of the most useful applications of fan draught is to augment the capacity of existing boiler plant. The plant may perhaps have been added to until it is entirely beyond the capacity of the old chimney, and the draught is poor and sluggish. At once the boiler fires can be brightened up and one or two boilers perhaps laid off as spares, simply through the aid of a fan. Economy is secured in first cost and it is secured in better combustion with less air; but more should still be sought.

A chimney obtains its power by virtue solely of its internal high temperature. It is computed that under ordinary conditions an internal temperature of 500° F. will produce as good a draught with a chimney of 100 feet as would be produced by a chimney of 175 feet with an internal temperature of only 250°. With a fan this is reversed. The cooler gases demand the smaller fan. It is productive of a double effect to add further economizer surface, because the waste gases are further cooled thereby and the fan action is improved. With a chimney, the addition of more pipes to the economizer system reduces the draught and puts in resistance to the impoverished draught.

It has been found as the average of nine plants that the gases left the economizers at 270°, and that the economizers showed 14.64 per cent. of economy. If desired, the gases rejected by the economizer may still be used to warm the air passing to the boiler fires with further economy. In the writer's own experience it would appear that the use of economizers has tended to the use of chimneys of larger capacity than where no economizers are employed, as might be expected. By raising the intensity of combustion and reducing the air supply, the total air passing to the chimney should be considerably reduced with fan draught. This greatly enhances the value of the heating surface of both boiler and economizer.

There is a further economy possible with fan draught that may commercially surpass all other economies. This is the ability to burn inferior fuels, the calorific capacity of which is much greater than their price. Some of the worst coals have three-fourths the calorific capacity of the good coals, but cost less than half as much, while they will produce double as much steam per unit of cost.—W. H. Booth, in "Cassier's Magazine" for December.

AMERICAN VS. ENGLISH ENGINEERING METHODS.

At a meeting of the Manchester Association of Engineers, held a short time ago, Mr. Edward Wood, of the Ocean Ironworks, read an interesting paper on "American vs. English Methods of Conducting Engineering Establishments." Touching first upon the preparation and education of boys, he remarked that there was a danger in England of taking boys from school too early; what was wanted was a more thorough grounding in education and a better knowledge of elementary science. Long apprenticeships were not necessary to success in any trade, and it was better for a boy to start work with a good education, and with the knowledge that he must think, than that he should commence directly he was able to run errands or copy a letter. One thing that struck him in America, as in contrast with English engineering firms, was the readiness with which strangers were shown over works, the methods of working explained, and new inventions pointed out, and the Americans were distinctly of opinion that it paid them from a business point of view. One of the most striking features of all the engineering works he had visited in America was the fact that quite young men were in positions of importance and trust. Another system that prevailed was to have "understudies" for all important positions. It was also the custom for engineers there to make everything they possibly could to their own standard or template. If they got an inquiry for something not in their catalogue they referred the engineer to some other manufacturers. They made a point of having very good men as inspectors, whose duty it was to pass machinery and work of every description before it was sent off. After referring to the manner in which new machines or methods for saving labor were taken up in America, regardless of first cost, Mr. Wood remarked that the wages of skilled workmen there were at least twice as high as those paid in England or Scotland, and piecework seemed very general, but the cost of living was much greater. In many establishments they worked double shifts—night and day. The men started and stopped to the minute, were satisfied with fewer holidays, and worked slightly longer hours than in England. On the whole, it appeared that whilst the wages all round were much higher in America, still very much more was required of masters and men; the pressure was greater, or, to use a technical term, the "voltage" was much higher. In conclusion, Mr. Wood observed that in England we now seemed to realize that we must look well to our laurels if we were to remain the first commercial country in the world.

In the course of a discussion on the paper, Mr. E. C. Constantine expressed the opinion that about fifteen was the age at which the average boy should commence work. As to education, this was certainly required, not only in the lower and intermediate ranks but also for the employers. Mr. Vose urged that a settlement on the piecework question in the engineering trades should be pressed home. Mr. Cooke observed that there were not finer opportunities anywhere than in England at the present time to obtain a sound technical education. As to the piecework question, this was absolutely in the hands of employers today, and he must say that, with few exceptions, he has found his workmen very reasonable to deal with. Mr. Loscher remarked that whilst ample opportunities were afforded at the evening schools in, say, Manchester or London, the ordinary school education left much to be desired, and lads on leaving school did not seem to have a proper sense of responsibility in connection with the business or trade they were learning. Mr. J. Saxon said that in England we had during the last few years made splendid progress in these things where we were behind. A shorter apprenticeship would be sufficient if the youth had previously received a good technical training. Mr. Yates observed that they went very minutely into the question of shop costs in America, and he thought that was one reason why they got the men to do more work. Mr. Hans Renold said he made a practice of sending his foreman round in turns with any visitor who wanted to go through his works. He found that as well as showing the visitor something, they often learned something from him. The chairman, Mr. T. Ashbury, pointed out that there were circumstances affecting American engineering works which were different from those affecting English works, but many of their methods were well worth imitation.

WATER PURIFICATION BY MEANS OF OZONE.*

Dr. Gg. Erlwein describes in "Schilling's Journal für Gasbeleuchtung und Wasserversorgung" an experimental plant for the purification of water by means of ozone, erected in Berlin some three years ago by Messrs. Siemens & Halske. The plant is designed to deal with 2,200 gallons of water per hour, which corresponds approximately with the requirements of a town of 5,000 inhabitants. The experiments, which have been carried out with the assistance of well-known German water experts and authorities on hygiene, were undertaken with the object of testing the practical utility of the electro chemical process of purifying or sterilizing drinking-water on a wholesale scale. The apparatus used to effect the absorption of the ozone resembled a scrubber, having small brick chambers filled with gravel, in which the water, previously cleansed of suspended matter by passage through a rapid filter, percolated through the fine interstices of the gravel, encountering on its way the ascending ozone. The ozone generators used were of the Siemens plate and tube type, with and without an air dryer. Pressures of from 8,000 to 12,000 volts were used to work these generators, which yielded an average of 20 grams to 25 grams of ozone per horse power hour, with a concentration of from two to three grams per cubic meter of ozonized air. After exhaustive experiments with the plant the following report of the bacteriological and chemical results obtained was drawn up by Messrs. Siemens & Halske:

A. Bacteriological.—The river water passed into the ozone chamber, which water contained 100,000 to 600,000 microbes per cubic centimeter and before admittance into the chamber was cleansed of suspended matter by passage through a Kröhnke patent rapid sand filter, could in most cases be completely sterilized by the ozone treatment, in spite of its unfavorable quality. In all cases it was possible to reduce the microbes from two to nine per cubic centimeter—a number far below the limit of 100 microbes per cubic centimeter which is permitted in ordinary waterworks practice.

B. Chemical.—The degree of oxidation of the water experimented with—on an average, 3.76 oxygen or 14.9 permanganate—was reduced about 18 per cent. by the ozone treatment. The free air in the water was increased by 10 to 12 per cent., and the oxygen by 36 to 39 per cent. There was no increase of nitric acid. The water flowing from the service reservoir gave off no smell, and was tasteless, nor were any signs of ozone reaction present. The ozone consumption (O_3) amounted to 2 grams per cubic meter of sterilized water.

The cost of treating 1,000 gallons of water by the Siemens process in a works designed for an output of 26,000 to 33,000 gallons per hour amounts in all to .65d., the power required being reckoned at .6d. per horse power hour. Of this amount the cost of energy represents .41d.; wages, repairs, and filtering .086d.; interest on load and depreciation, .165d. The total cost of 1,000 gallons of sterilized water delivered at the point of consumption, including filtration, pumping for towers and high-pressure service, with depreciation and interest—allowing for depreciation of the pipe system—amounts to 1.8d. The cost of a plant designed for a capacity of 33,000 gallons per hour, exclusive of service mains, amounts to £6,750, of which £3,000 is represented by buildings, filtering plant, and the pumps for the high-pressure service.

At the end of the report, the ozone treatment, in conjunction with preliminary filtration at the rate of 10 to 15 cubic feet per square foot of filter surface per hour, is recommended for purifying surface water intended for drinking purposes. It is also suggested as a remedy, where other means have failed, for iron discoloration in water. The arrangement of the experimental plant erected in Berlin is as follows. There are three parts: (1) a rapid filtering plant, through which the river water is cleansed of suspended matter; (2) the chamber filled with fine gravel, through which the water percolates and becomes saturated with the ascending ozone, and so sterilized; (3) the ozone generator situated in a hermetically sealed box, and consisting of pairs of plates, superimposed and insulated from each other, connected to the high-tension poles, dry air being forced through the discharging space. In the plate generators the discharging space is formed by superimposed plates, the upper plate of a pair being a glass disk partly covered with thin foil, while the lower plate insulated from the upper one by means of glass strips, in an ozone-resisting metal plate. The introduction of the previously dried and cooled air into the discharging space is effected either in the longitudinal direction of the plates or centrally through the lower plate of each pair. Both plates connected to the 12,000 volt circuit are insulated from earth. A pair of plates having a discharge surface of 11 square feet requires one-half horse power to work it. The plate apparatus yields from 20 grams to 25 grams of ozone (O_3) per horse power hour, provided the volume of air conducted through it be proportioned to yield the two grams of ozone per cubic meter of air which is necessary to insure sterilization. On the other hand, the discharging space in the tube ozone apparatus of the firm's latest type is formed by concentric metal tubes, both cooled by means of water. Between the two metal tubes is inserted an insulator in the form of a mica cylinder attached to the inner side of the outer tube. A combination of seven such tubes forms the complete apparatus. The individual tubes are inclosed in a cylinder like fire-tubes in a locomotive boiler, the water for cooling the tubes circulating between them. The outer tubes are earthed by the circulating water.

The inner tubes are likewise cooled by means of water, which is conveyed to and from them by an automatic arrangement, consisting of two cups, attached to an insulated rod and always insulated from earth, which alternately tilt over. This tube apparatus with its water-cooling arrangements also yields from 20 grams to 25 grams of ozone (O_3) per horse power hour, with a concentration of 3 grams per cubic meter of air.

Electric Line Between London and Dover.

There is now being advertised in the public press a project for a straight electric line between London and Dover. It professes to save mileage as compared with the existing London, Chatham and Dover. The parties promoting the scheme are said to be interested in existing "tube" lines in London and other projects of a like description, which combine to make up an imposing programme.

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*From the "Electrical Engineer," London.

INDIVIDUALISM AND INVENTION.

The day of consolidation is rapidly supplanting that of individualism. Even in lines where individualism is most unrestrained there is evidence of a new order of things. Take even the recent development of the Klondike. The various claims were largely operated by companies, the picturesque, solitary miner striking it rich, being a much rarer figure than in the days of the earlier gold fields. The popular idea of an inventor is a man-like Politsy, breaking up the furniture to the accompaniment of his sorely tried spouse's upbraiding in order to get fuel to heat his precious oven, wherein lies his precious crockery. But this old-time inventor will soon be as extinct as the old-time gold miner with his pick and shovel. It is a fallacy to suppose for an instant that brilliant ideas glide, ghost-like, into the chambers of one's brain in a moment of almost divine inspiration, just as much as it is to believe that it is a matter of luck. A great invention is almost always the result of careful thought and systematic study. This is shown in many ways, but nowhere more notably than in the rapidly growing practice of employing inventors, by the proprietors of great industrial establishments, for the sole purpose of improving and perfecting the machinery in use about the plant. This is now quite a common practice. This person may be a regularly equipped engineer, but the chances are that he is some clever workman who has shown a suitable degree of intelligence, an aptitude for the work, and some little energy. His labors consist largely of keeping himself posted on the newest improvements in his general line of work, and of making use of his up-to-date knowledge for the benefit of his employers.

This is not a new idea, but, until lately, has not been the general rule in this country. In Germany, however, it is a custom which has long prevailed in one form or another. Every large industrial establishment has at least one chemist on its staff. Sometimes there are several, with a large corps of assistants, and these men may work for many months or years without being able to make any substantial showing in return for the money they take away in the shape of wages and laboratory supplies and apparatus, but a single achievement will often make full atonement for this outlay, and return a hundredfold profit on the investment to their employers. Two chemists labored incessantly for two years in the laboratory of a print works in Germany, and during all that time they could do nothing more than report "progress," but finally they had the pleasure of announcing that they had succeeded in making an artificial indigo. The real indigo had been used in enormous quantities, and was very expensive, and the substitute could be made at a cost which was trifling in comparison. This achievement made fortunes for the two untiring workers who had discovered it, and also for their employers, and to-day the manufacture of synthetic indigo is one of the important industries of the German Empire, despite the fact that it has been but a few years since these two chemists were working day after day in the systematic search for what they knew would be a grand discovery if they should finally succeed in attaining the desired end.

A manufacturer may be in need of a piece of machinery to form some piece of work in his factory. It may be to peg shoes, trim corks, cut buttons, or any one of a thousand and one things. In this case he does not set about to find some one who has dreamed such an improvement, but he seeks some man of ingenuity who may have a more or less expert knowledge of machinery, and explains the situation to him. It may be the work of a week or month or more, or the worker may get balked at a certain point and be able to proceed no further. In this case he will call to his assistance a fellow expert, and together they will work out the end to be accomplished, but the ultimate completion of the design is only a matter of time. There is no such thing as luck or accident about it.

All this goes to point to the fact that the day of haphazard invention is past, if, indeed, such a day ever existed. Successful ends are only achieved by systematic application and hard work, and the man who has made an invention of any kind must be given the credit for this. The inventor's work is never done, his field is never covered, and there are just as great openings for genius to-day as there ever were, but it must proceed on regular and orderly lines. It should not be a difficult matter for any one to look around him and observe some nuisance and start about to abate it, or to realize that some operation which he has been performing every day for many years, perhaps, is needlessly prolonged, and for him to set about to shorten it, and herein may lie the key to some great revolutionizing invention.—"American Artisan and Hardware Record."

Lundell Motors.

The various types of Lundell motors manufactured by the Sprague Electric Company of New York are unequaled for all purposes of machine driving where direct current is used. Unusually efficient and remarkably durable, in addition to many other points of superiority in design and construction, they constitute the highest type of power apparatus on the market. They are made in sizes from 1-20 hp. to 1,000 hp. and may be either open or inclosed as desired.

They can be belted, geared or direct connected and can be attached to the floor, wall or ceiling.

The advantages of operating machines with Lundell motors are briefly as follows: Economy in cost of power, economy in cost of repairs, economy in cost of production, economy in floor space, independent operation of machines, reliable operation of machines, efficient operation of machines, less danger to life and property, lower rates of insurance and cleaner and lighter premises. All of which means that more and better work can be done at less cost.

A detailed description of the various types of motors is given in Bulletin No. 206, which may be obtained free of charge by addressing the company as above.

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General Greely has received a report from the chief signal officer at Alaska that the overland telegraph line from Valdez toward Fort Egbert has been extended from the fort about 150 miles. An extension has been built from Egbert to meet the Valdez line. When a gap of 130 miles is closed telegraph communication will be established by way of the Canadian lines through Valdez.

LONDON NOTES.

[From our London Correspondent.]

The Underground Railway.

The arbitration proceedings regarding electrical equipment resumed yesterday, October 29th. Mr. Perks, who is the chairman of Mr. Yerkes' line, gave evidence at considerable length, and the hearing looks like lasting several days.

New Telegraph Cables.

The Eastern and Eastern Extension Telegraph Companies, who have jointly been laying a new cable from England to Cape Town and on to Australia, have completed the work. Altogether the new cable laid is 15,000 nautical miles, and its manufacture and laying has cost over $15,000,000. The first part of the work consisted in the laying of a new cable between Cornwall and the Cape, and was completed early in 1900. The extension from South Africa to West Australia has just been accomplished. Next year the section between Perth and Adelaide will be laid. The companies hope to be in a better position to efficiently cope with growing Colonial traffic, now that they have this new line.

Thermo EMF. and Resistance of Certain Metals.

In his Physical Society paper on "Variation With Temperature of the Thermo EMF., etc," Mr. E. P. Harrison concludes from his investigations that the thermo-electric change in nickel coincides approximately with the resistance change, but that no thermo electric peculiarity exists for iron-copper at the temperature of the iron resistance change.

CENSUS REPORT OF ELECTRICITY IN CONNECTICUT.

Hon. S. N. D. North, the chief statistician for manufacturers of the twelfth census, has transmitted to Director Merriam his report upon the manufacturing and mechanical industries for the State above named, for the census year 1900, taken in accordance with the provisions of section 7 of the act of March 3, 1899, which requires that "schedules of inquiries relating to the products of manufacturing and mechanical establishments shall embrace the name and location of each establishment; character of organization, whether individual or co-operative or other forms; date of commencement of operations; character of business or kind of goods manufactured; amount of capital invested; number of proprietors, firm members, co-partners, or officers, and the amount of their salaries; number of employes, and the amount of their wages; quantity and cost of materials used in manufactures; amount of miscellaneous expenses; quantity and value of products; time in operation during the census year; character and quantity of power used; and character and number of machines used."

ELECTRICAL APPARATUS AND SUPPLIES.

Under this head 17 establishments reported having a total capital of $2,513,812, the value of the land being $69,400, that of the buildings $174,949. The machinery, tools and implements were valued at $422,696 with cash and sundries placed at $1,846,767.

These 17 establishments were owned by 8 proprietors and firm members.

The number of salaried officials and clerks was 142 with salaries amounting to $170,490.

The average number of wage earners was 961 and the total wages paid was $405,604.

The average number of male wage earners, over sixteen years of age, in these establishments was 690 with their wages estimated to be $336,112.

The average number of female wage earners, over sixteen years of age, was 307 with the wages placed at $69,307.

These 17 establishments reported miscellaneous expenses to the amount of $222,400, of which $7,240 was for rent of works; $4,797 was for taxes not including internal revenue; $210,063 for rent of offices, interest, etc., and $300 was for contract work.

The total cost of material used in these 17 establishments is placed at $1,973,715, of which $1,954,315 represented principal materials, including mill supplies and freight; and $19,400 was for fuel and rent of power and heat.

The value of the products, including custom work and repairing of these 17 establishments, is placed at $3,167,842.

ELECTRICAL CONSTRUCTION AND REPAIRS.

Under this head 25 establishments reported having a total capital of $77.562, the value of the land being, $2,050; that of the buildings, $5,050. The machinery, tools and implements were valued at $9,505, with cash and sundries placed at $60,957.

These 25 establishments were owned by 30 proprietors and firm members.

The number of salaried officials and clerks was 12, with salaries amounting to $7,430.

The average number of male wage earners, over sixteen years of age, in these establishments was 88, with their wages estimated at $51,868.

These 25 establishments reported miscellaneous expenses to the amount of $7,327, of which $3,454 was for rent of works; $590 for taxes not including internal revenue; and $3,283 for rent of offices, interest, etc.

The total cost of material used in these 25 establishments is placed at $168,459, of which $168,032 represented principal materials, including mill supplies and freight; and $427 was for fuel and for rent of power and heat.

The value of the products, including custom work and repairing, of these 25 establishments is placed at $288,526.

ELECTROPLATING.

Under this head 12 establishments reported having a total capital of $23,663, the value of the land being $100, that of the buildings, $1,200. The machinery, tools and implements were valued at $12,517, with cash and sundries placed at $9,846.

These 12 establishments were owned by 15 proprietors and firm members.

The average number of wage earners was 35, with the total wages paid amounting to $16,773.

These 12 establishments reported miscellaneous expenses to the amount of $3,410, of which $2,799 was for rent of works; $107 for taxes, not including internal revenue; $504 was for rent of offices, interest, etc.

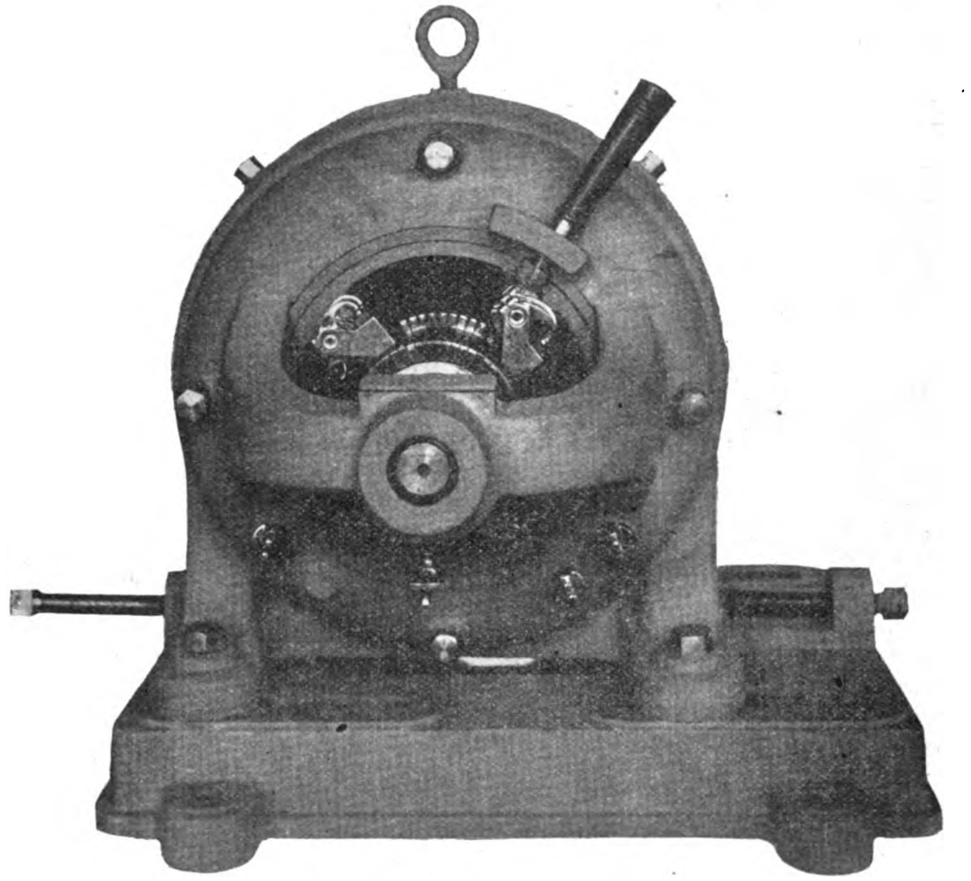
The total cost of materials used in these 12 establishments is placed at $8,554, of which $6,845 represented principal materials, including mill supplies and freight; and $1,709 was for fuel and rent of power and heat.

The value of the products, including custom work and repairing of these twelve establishments, is placed at $47,302.

"M" TYPE MOTORS AND GENERATORS.

The "M" Type Motors and Generators, manufactured by the Reliance Electric Company of Milwaukee, Wis., are said to be growing very popular. These machines are provided with solid cast-iron bases to which the steel frames are bolted, in a manner that admits of easy adjustment to govern the tension of the belt. The construction of the base is such that solidity and alignment are absolute.

The heads are reversible and made of select grey iron casting, fitted to the frame with a perfectly tight machine joint, and held securely in place with steel tap bolts, screwed into steel lugs on the frame.



The Reliance Electric Company's Generator.

The bearings are gun metal of generous dimensions with large oil pockets and "ring oilers," insuring cool running.

The shaft is made of the best quality of steel and of large diameter, ground and polished to a perfect gauge at bearings.

The armature core, herewith illustrated, consists of laminated double annealed electric steel disks thoroughly treated with insulating material and assembled under a heavy pressure upon a cast-iron spider that forms a series of air ducts. The assembled disks upon the spider are separated at intervals with a plate that forms a series of vertical ducts through which a constant flow of air is forced when the armature is in motion.

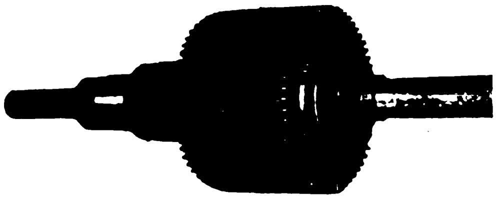
The "armature coils" are all "form wound" which insures perfect uniformity in length and weight. Each coil is insulated in a thorough manner with the most reliable materials and subjected to a break-down test of 2,000 volts alternating current. The system of winding is such that a positive circulation of air is maintained through the coils and end winding while the machine is in operation. After the coils are inserted in the slots of the armature disks and before being connected to the commutator, a further test is applied to prove that part of the construction.

The field coils are also "form wound" for the same reason and advantage that apply to the armature coils. The "form coils" being interchangeable, duplicate coils can always be had promptly for repairs and at a nominal cost. They are slipped over the pole pieces before bolting same to the frame, and are easily removed or replaced. The field coils are extra well insulated and thoroughly tested and protected with tape winding and extra hard varnish, making a finish that is neat and serviceable.

The commutator, upon which so much depends, is built up with the greatest care, of pure lake-copper bars and insulated with the best quality india mica. The bars are held securely in place by wedge shaped steel rings and ring nuts threaded to the shell and perfectly insulated with india mica. The commutator is constructed under a heavy pressure and baking process.

The brush-holder manufactured by the Reliance Electric Company, is a very efficient device, made of brass and is constantly reliable. The carbon brushes are of ample size and can be moved to any desired position on the commutator by an ingenious arrangement that is simple in construction and perfect in operation.

"Our motto," writes the Reliance Electric Company, "is to use only the best of everything." Tests of the electrical parts of the apparatus are made as the work progresses, and finally the completed machine is given several severe tests to make doubly sure that the apparatus is fully up to the guarantee before the same is shipped.



The Reliance Electric Co.'s Armature.

An Exhibition of Scientific Apparatus.

There is on view in London just now an exhibition of scientific apparatus constructed by pupils and teachers under the London School Board, for the purpose of teaching and illustrating some of the branches of experimental science. This is a new and interesting move on the part of the board, and the collection of induction coils, telegraph instruments, motors, voltmeters, galvanometers, etc., used in teaching magnetism and electricity, is said to contain some ingenious specimens.

CANADIAN NOTES.

(From our Ottawa Correspondent.)

It is estimated that the total cost of laying conduits in the city of Montreal, Que., for the use of the various electrical concerns doing business in the city, will be upwards of $7,500,000.

The Royal Electric Company has signed the lighting contract with the city of Montreal, under which, after January 1, 1903, the company will get a five-year extension of its present contract with the city at the price of $60 per arc lamp, instead of $120 per lamp under the old contract.

Mr. G. G. McPherson, barrister, acting on behalf of a number of Pittsburg, Pa., capitalists, has written an open letter to the mayor of Stratford, Ont., notifying him that these gentlemen will apply for a charter at the approaching session of the Ontario Legislature for an electric railway from Stratford to Mitchell. They want a fifty-year franchise.

Mr. T. L. Cooper, hydraulic engineer of New York, who has been at Winnipeg, Man., inspecting the water power facilities on the Winnipeg River, for Messrs. Mackenzie & Mann, has gone to New York to order an immense electric plant by which electric power will be furnished to Winnipeg. The work will be installed next spring at the confluence of the Winnipeg and Whitemouth Rivers, and will cost about $50,000.

LEGAL NOTE.

Judge Hazel, in the United States District Court of Buffalo, N. Y., recently handed down decisions on the cases of the Westinghouse Electric & Manufacturing Company and the Thomson-Houston Company, against the Union Carbide Company. The judge decided that the defendants had infringed certain patents of the complainants for improvements on converters and transformers.

Municipal Electricians.

Mr. Frank P. Foster, of Corning, N. Y., secretary of the International Association of Municipal Electricians, writes us that there will be a meeting of the executive committee of the Association at Corning, December 14, to select and assign papers to be read at the meeting to be held at Richmond, Va., next year.

Public Protected.

Hon. Judge Wing of the Federal Court of Cleveland has just issued a permanent injunction with costs and damages enjoining a lawyer named Gorey from the manufacture and sale of an imitation of cascarets. Gorey imitated the boxes, the shape of the tablet and used a similar sounding name. This decision is to be commended. It is a long step in the right direction. Any dealer who will offer a substitute or say that something "is just as good" when cascarets are called for, does it for the purpose of making a few cents extra profit, which is at the expense of the customer's health.

Cascarets have been advertised freely in our columns, and as the result of making them known, cascarets to day have the largest sale of any bowel medicine in the world. They are always packed in metal boxes with the long tall "C" on the cover and each tablet stamped C. C. C. They are never sold in bulk or from jars. We deem it our duty to warn our readers against an imitation or substitute of this meritorious medicine, and if at any time they have ever been offered a substitute or an offer made to sell something "just as good" when cascarets have been asked for, we will be pleased indeed to have a letter to that effect or write direct to the Sterling Remedy Company, New York or Chicago.

INCORPORATIONS.

The Ontario Power Company, Ontario, Cal. Capital stock, $500,000.

The West Michigan Electric Light & Power Company, Grand Rapids, Mich, Capital stock, $10,000.

The Genoa Electric Company, Genoa, Ill. Capital stock, $10,000. Incorporators George Loptien, H. L. Canfield and A. O. Anderson.

The La Crosse Gas & Electric Company, La Crosse, Wis. Capital stock, $600,000. Incorporators: William W. Cargill, William S. Cargill and George MacMillan.

The Commercial Electric Time Company, New York City. Capital stock, $250,000. Directors: Ralph Jonas, Henry Best and D. M. Edwards of New York City.

The Adirondack Electric Company, Lake Placid, N. Y. Capital stock, $100,000. Directors: A. W. Boynton, Keesville, H. S and F. A. Isham, Lake Placid.

The People's Gas & Electric Company, Burlington, Ia. Capital stock, $200,000. Officers: B. E Sunny, president; Theo. P. Bailey, vice president and treasurer; George P. Townsend, secretary.

The Century Light & Power Company, New York City. Capital stock, $150,000. Directors: G. W. Glaentzer of Ridgewood, N. J.; C B. Hobbs of Great River, L. I., and J. D. Fearhake of Brooklyn.

The New England-Welling Lighting Company, Jersey City, N. J.—to produce light, heat and power. Capital stock, $100,000. Incorporators: Henry L. Van Syckel, Francis J. Anderson and Harry F. Arkinson.

The Madison County Gas & Electric Company, Oneida, N. Y. Capital stock, $200,000. Directors: George S Sheppard, John A. Underwood, Fred H. Lynn, Mark L. Wilhelm, of Penn Yan, and George M. Wilhelm, of Oneida.

The American Town Lighting Company, Trenton, N. J.—to manufacture and supply electricity and gas Capital stock, $1,000,000. Incorporators: Henry N. Galloudet of Elizabeth, John J. Daly of Brooklyn, Edwin B. Ware, Archie L. Wisner and Joseph E, Carrington of New York.

The Kern Power Company, Los Angeles, Cal.—to manufacture electricity for light, heat and power; to acquire water rights and construct bridges and pipe lines and to secure all kinds of franchises. Capital stock, $5,000,000. Directors: H. E. Huntington, S. W. Hellman, A. Borel, C. De Guigne, W. G. Kerckhorf, A. C. Batch and H. W. O'Melveny.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED NOV. 19, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

686,739. Electric Railway. Frank Klepetko, Greatfalls, Mont., and George K. Fischer, Salt Lake City, Utah. Filed July 19, 1899.

686,768. System of Electrical Propulsion for Railway or Other Cars. Gordon J. Scott, Philadelphia, Pa., assignor of one-half to William S. Janney, same place. Filed March 8, 1901.

686,862. Electric Railway. James F. Munsie, Brooklyn, N. Y.; Julia F. Munsie, administratrix of the said James F. Munsie, deceased, assignor to Webster M. Clickner, Bruynswick, N. Y. Filed Aug. 24, 1899. Renewed July 31, 1901.

686,959. Car-Fender. Charles H. Hofmeister, St. Louis, Mo., assignor of one-half to Michael M. Sutter and Henry J. Braun, same place. Filed July 27, 1901.

686,973. Railway-Crossing Signal. Burton A. Karr, Council Bluffs, Ia., assignor to the Karr Signal & Power Company, Omaha, Neb. Filed July 18, 1901.

686,974. Railway Signaling Device. Lillian C. Karr, Council Bluffs, Ia., assignor to the Karr Signal & Power Company, Omaha, Neb Filed July 20, 1901.

687,087. Switch-Signal. Bertis H. Urschel and Edmund P. Thomas, Sugar Ridge, O Filed May 26, 1900.

687,091. Rail-Bond. Carl Walther, Berlin, Germany, assignor to the General Electric Company of New York. Filed June 27, 1900.

687,098. Electric Railway. Granville T. Woods, New York City, assignor to the General Electric Company of New York. Filed June 29, 1900.

ELECTRIC LIGHTS AND APPLIANCES.

686,910. Regulator for Incandescent Lamps. Frederick C. Schofield, Lonaconing, Md., assignor of one-half to Andrew Spier and William J. Mooney, same place. Filed March 9, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

686,729 Brush-Holder for Dynamo-Electric Machines. Gustavos Heidel, St. Louis, Mo. Filed March 18, 1901.

686,735. Adjusting Device for Electric Igniters for Explosive-Motors. Charles T. Jeffery, Chicago, Ill., assignor of one half to Thomas B. Jeffery, same place. Filed Dec. 10, 1900.

686,835. Magnetic Separator for Ore or Concentrates. Marcus Ruthenburg, Philadelphia, Pa. Filed May 28, 1900.

686,856. Dynamo Electric Machine. Walter Langdon-Davies and Alfred Soames, Surrey, Eng. Filed June 14, 1901.

686,859. Electric Generator and Distributer for Medical Treatment. Edwin L. Madden, Kanawha, Ia. Filed March 28, 1901.

686,889. Magnetic Separator. Herbert M. Daggett, Philadelphia, Pa. Filed Aug. 7, 1899. Renewed Aug. 23, 1901.

666,918. Automatic Circuit-Breaker. Henry P. Ball, New York City, assignor to General Incandescent Arc Light Company of New York. Filed June 25, 1900.

686,942. Electric Servomotor. Pierre M. Le Hegarat, Paris, France. Filed March 12, 1901.

687,042, Anti-Hunting Device. Alexander D. Lunt, Schenectady, N. Y., assignor to General Electric Company of New York. Filed June 25, 1900.

687,044. Rheostat Frederick Mackintosh, Schenectady, N. Y., assignor to General Electric Company of New York. Filed April 22, 1901.

687,048. Transformer. Walter S. Moody, Schenectady, N. Y., assignor to General Electric Company New York. Filed May 31, 1901.

687,059. Indicating Instrument. Thomas F. Mullaney, New York City, assignor to General Electric Company of New York. Filed Aug. 16, 1901.

687,053. Magnetic Separator. Robert McKnight Philadelphia, Pa., assignor to Metallic Condense Company of Delaware. Filed Feb. 4, 1901.

687,065. Circuit-Breaker. Robert H. Read, Schenectady, N. Y., assignor to General Electric Company of New York. Filed July 18, 1901.

687,141. Current-Transformer. Augustine R. Everest Lynn, Mass., assignor to General Electric Company of New York. Filed July 29, 1901.

687,143. System of Motor Control. Philip Farnsworth, Schenectady, N. Y., assignor to General Electric Company of New York. Filed April 22, 1901.

687,147. Regulator. Richard Fleming, Lynn, Mass., assignor to General Electric Company of New York. Filed July 20, 1900.

TELEPHONES AND TELEPHONE APPARATUS.

686,892. Automatic Telephone System. Ernest A. Faller, Baltimore, Md., assignor of one half to James W. Chisholm, same place. Filed Aug. 22, 1901.

686,925. Party-Line Selector System. Thomas C. Drake, Malta, O. Filed March 2, 1901.

687,008. Toll-Collecting Machine for Telephones. William A. Foss, Cleveland, O., assignor to the American Toll Telephone Company, same place. Filed March 25, 1901.

MISCELLANEOUS.

686,704. Bushing for Interior Conduits. William F. Bossert and Frederick T. Foxenberger, Utica, N. Y., assignors to the Bossert Electric Construction Company, same place. Filed Aug. 30, 1901.

686,782. Electrical Heater for Developing and Fixing Inks on Manuscripts. Evert M. Thompson, Indianapolis, Ind. Filed April 29, 1901.

686,832. Electric Conducting-Cable. John D. Peachey, Newark, N. J. Filed Sept. 21, 1900.

686,836. Electric Furnace. Marcus Ruthenburg, Philadelphia, Pa. Filed Aug. 4, 1900.

686,886. Separator for Storage Batteries. Rufus N. Chamberlain, Depew, N. Y., assignor to the Gould Storage Battery Company of New York City. Filed Sept. 21, 1900.

687,060. System of Motor Control. Charles L. Perry, Schenectady, N. Y., assignor to General Electric Company of New York. Filed June 21, 1900.

687,078. Alternating-Current System. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company of New York. Filed May 26, 1900.

687,121. Electric Battery. Edwin F. Callender, Galesburg, Ill., assignor of one-half to James J. Callender, same place. Filed April 17, 1901.

687,124. System of Electric Circuits. Frank E. Case, Schenectady, N. Y., assignor to General Electric Company of New York. Filed June 29, 1901.

687,140. System of Electrical Distribution. Augustine R. Everest, Lynn, Mass., assignor to General Electric Company of New York. Filed May 31, 1901.

REISSUE.

11,945. Railway-Brake. Alfred Green, Rochester, N. Y., assignor, by mesne assignments, to the Compound Magnet Brake Company of New Jersey. Filed July 27, 1901. Original No. 670,873, dated March 26, 1901.

THE TELEPHONE WORLD.

An Independent Telephone Combine.

The much rumored consolidation of all the independent telephone companies in Wisconsin will probably be effected early in the spring. This information is given out by one of the directors and principal stockholders of the Little Wolf River Telephone Company, which has its main office in Fond-du-Lac. Previous efforts to get a statement from any of the local stockholders of the company have been without avail, but it is now stated authoritatively that the proposed consolidation will be effected early next year, when the reorganization of the combined system will probably be commenced. The stockholders and directors of the Little Wolf River Telephone Company have been approached with reference to entering the combine and have expressed a willingness to do so. The consolidation will greatly increase the efficiency of the service of the various companies to enter the combine and will probably cause the construction of a number of additional toll lines and exchanges throughout the State.

The American Telephone Company began recently the work of erecting two telephone towers, one on the other side of the Allegheny River at Verona. The one on the Verona side of the river will be a short distance above the ferry landing. The other will be directly across the river, on the Montrose side. The purpose of the towers is to carry the heavy cables of the company over the river, this being one on the line of the company's direct communication between Philadelphia, New York and other Eastern cities and Chicago.

The Salisbury Telephone Company of Salisbury, Md., has disposed of its charter, franchises and properties to the Diamond State Telephone Company. The sale includes all the lines within the corporate limits of Salisbury, also the line extending from Salisbury to the corporate limits of Berlin, Md., and all the interest of the Salisbury Telephone Company in the Wicomico Telephone Company, which extends from Salisbury to Nanticoke Point. The price paid by the Diamond State Company for the properties was $20,000.

The Pioneer Telephone Company has been organized at Guthrie, Okla., with a capital stock of $500,000. The corporation will build and operate telephone lines throughout the United States, and the directors are John M. Noble, Bird S. McGuire and John N. Coulter of Pawnee, E. E. Westervelt, and David McKinstry, of Perry; and E. D. Nims, of Rolf, Indian Territory.

A cable dispatch from London dated November 20 states that considerable disappointment is felt over the announcement that the post office telephone system, just inaugurated, will charge virtually the same rates as the private companies. It had been expected that the Government would inaugurate a cheaper service.

The American Telephone Directory Company of Detroit, Mich., filed articles of association on November 15, with the clerk of the county. The company has a paid-up capital of $5,000, and the organizers are John D. Browning, of Reading, Pa., 4,800 shares; Charles E. Smith and Clark S. Potter, of Detroit, each 100 shares.

A new telephone line will at once be constructed connecting La Delle, Lake Bryon, Sheffeld and other suburban villages with Huron, S. D. President Zeitlow, of the Dakota Central Telephone Company, has the work in hand.

The Kandiyohi County Telephone Company of Minnesota is building a telephone line from Bird Island to Lake Lillian, where it will connect with a line to Willmar, Atwater and other places in Kandiyohi County.

A dispatch from Shell Rock, Iowa, states that E. H. Eckles of Tama County, has purchased the telephone line of the Cedar Valley Company, and will enlarge the system, taking in the surrounding towns.

Advices from Upper Sandusky, O., state that the United States Telephone Company has filed a million dollar mortgage to the Cleveland Trust Company on all its property in Ohio.

Efforts are being made in Philadelphia to organize a new union of telephone wiremen and installers such as is to be found in several other cities.

Arrangements are being made by the officials of the Iron Range Telephone Company looking to the improvement of the service at Cass Lake, Minn.

A large crew of men is now at work on the proposed long-distance telephone line between La Crosse, Wis., and Minneapolis.

A New Exchange for Milwaukee.

Milwaukee is to have a new telephone exchange and service, toll lines are to be established between Chicago, Milwaukee, Madison, La Crosse and Minneapolis, and in addition a special telegraph service between the same cities will be started, if everything runs smoothly with the Great Western Telephone & Telegraph Company, recently organized.

The company will apply soon for a charter from the State of Wisconsin, authorizing it to issue $500,000 worth of stock, with leave to increase to $2,500,000. As soon as the necessary papers can be drawn application will be made to the common council for a franchise for a telephone exchange in Milwaukee.

The city of Casper, Wyo., has reconsidered its action with reference to granting a franchise to the Rocky-Mountain Bell Telephone Company, which was recently refused permission to erect poles and run wires there, and the application has been granted. This will cause a change to be made in the plans of the telephone company, and instead of running the Lander-Thermopolis wire northwest from Douglas, the line will now pass through Casper. This will place the wool metropolis in connection with the wool growing sections.

At a meeting of the directors of the Consolidated Telephone Company, held at Allentown, Pa., recently, Mr. S. D. Wayland, manager of the Lackawanna Telephone Company, was appointed secretary and general manager. The Consolidated Telephone Company comprises the independent companies in the Lackawanna, Wyoming and Lehigh Valleys, together with a number in New York State. The headquarters of the new general manager will probably be in Philadelphia.

The case of the State of Minnesota against the Northwestern Telephone Company, on appeal from an order of the district court, was lately argued before the Supreme Court and submitted. In this case the State attempted to collect taxes on the building of the company. The company claimed that the gross earnings tax was in lieu of a tax on specific property and that such property could not be taxed.

Between 20 and 30 farmers in Corinth and Bloom townships, says a dispatch from Downs, Kan., are having a rural telephone system constructed. The farmers will be connected with the Downs plant, and in fact with the entire system in that part of the State. Rural telephones will be constructed in other directions out of that town. The drouth last season did not impoverish the farmers, but on the contrary they made money on their crops, and can afford luxuries.

The longest rural telephone line in South Dakota is that extending north and west from Springfield, Bon Homme County. Farmers along the line can sit in their homes and converse with their friends in any of the towns of Southeastern Dakota or Northwestern Iowa. This is the pioneer rural line in that part of the State. The wires are stretched on fence posts, trees and buildings, but the regulation telephone wire is used, so that the instruments work perfectly.

The Hudson Telephone Company has been reorganized with William J. Foster of New York as president, J. B. Curtis of New York as vice-president and general manager; Marcus Higginbothem as secretary, and A. Norton Taylor, of East Orange as treasurer. Fred Jonas of Jersey City has been installed as general superintendent, and the company is preparing to extend its system in Hudson County, with headquarters at 312 Henderson street.

The Bell Telephone Company in Salt Lake City, Utah, maintains a regular school or department of instruction for freshman "hello girls," who are not matriculated into the regular curriculum until they have mastered the intricacies of the switchboard and how to conduct the business of the company.

The Mississippi Valley Telephone Company has put in several 'phones in and around West Burlington, Ia. Seven farmers between there and Middletown have put them in their residences and a good many, it is stated, will do likewise in a short time.

Manager Andrews of the Farmington Valley, Conn., Telephone Company, denies the report that it will be absorbed by the Southern New England Company. He says the line is doing a paying business and will be extended.

The Cherryville Telephone Company of Flemington, N. J., has elected the following officers: President, Samuel K. Everitt; secretary, Rev. A. E. Finn; treasurer, Andrew J. Pierson.

Keeping Dust from Telephones.

Dust in telephone operating rooms forms a serious obstacle to smooth proceedings, settling in the connections of the switchboard and making them imperfect. The Twin City Telephone Company of St Paul, Minn., has decided to try a remedy. It is installing in its new exchange building a system of heating and ventilation that, it is expected, will prove a profitable investment.

The building will be heated by hot air driven into the operating room by huge fans located in the basement. Before entering the room, this air will be forced through a spray of water which will remove all dust and other impurities.

Another feature of the new apparatus is that in summer the air by percolating through the spray of cool water will be cooled, and the temperature of the operating room will at all times be comfortably pleasant. In winter this air will be heated. From no other source will air be permitted to enter the room.

The company says it is impossible for the operators to do the best work in a body of dead air. By the new arrangement the atmosphere will be changed every 10 minutes.

L. H. Lancaster, a representative of the American Telephone Company, in which Congressman Broussard is interested, was recently in Donaldsonville, La., looking over the field preparatory to the establishment of an exchange there. The news of the proposed opening of the exchange is received with general approbation. The American Telephone Company proposes to place a telephone in every business house and residence and no charge is to be made except when the instrument is used. Mr. Lancaster will appear before the council to explain the plans of the company he represents, and it is a foregone conclusion that the privilege of stringing wires through the streets will be granted to the new company, and that ere long the public will have the benefit of cheap telephones.

The Citizens' Telephone Company has written contracts for 45 new 'phones in Grand Rapids, Mich., this month. The work outside the city is also developing satisfactorily. A representative has been working in Caledonia, and as a result that exchange will have 100 subscribers. The company has shipped 15,000 feet of underground cable to Ionia for the new exchange there, and has received its first consignment of 100 new telephones for that exchange, and about 30,000 feet of conduits has been installed there, and the company expects to begin giving service in Ionia within a month.

A new line of the East Tennessee Telephone Company was opened in Knoxville for business a short time ago. The line extends to Middleboro, Ky., with officers at all the larger stations en route, including Shawnee, Cumberland Gap, Tazewell, Powder Springs, Powell River, etc. The line is one of the longest toll lines in East Tennessee.

A local telephone company has just completed its organization in Dayton, Ia., J. A. Lindberg being chosen president, Dr. M. F. Anderson vice president; Dr. H. E. Nelson, secretary, and E. M. Lundien treasurer. It is called the Dayton Telephone Company, and will operate a city and rural system.

Cayce Todd, manager of the Cumberland Telephone Company, was recently in Gleason, Tenn., preparing to put in a local exchange for his company. He secured several subscribers and an exchange will be built at an early date.

Edward L. Granel and Stephen H. Gallagher of Carthage, N. Y., have been granted a patent on an anti-humming device to be applied to telephone and telegraph wires.

The Dixie Telephone Company of Grundy County, Tenn., has filed an amendment to its charter increasing its capital stock from $10,000 to $25,000.

The Richmond, Va., Telephone Company has improved its service by putting in the Kellogg switchboard, and wants increased rates in order to furnish the best service.

The North Ridgeville, O., Telephone Company has increased its capital stock from $2,000 to $10,000.

Muir, Mich., will have a telephone exchange shortly, to be installed by the Union 'Phone Company of Alma.

TELEPHONE INCORPORATION.

The American Push Button Telephone Company, New York City. Capital stock, $300,000 Directors: E. G. Potter and F. P. Duryea, of New York City, and R. S. Kriteller of Brooklyn.

GENERAL ELECTRICAL NEWS.

Lighting.

Atkinson, Ill.—An ordinance has been passed providing for the issue of electric light bonds. Fred Johnson, city clerk.

Blue Mound, Ill.—The citizens of this place will soon hold a special election to decide whether the city shall have an electric light plant of its own.

Brooklyn, N. Y.—The consolidation of all the electric light and gas companies of New York and this this city is believed to be imminent.

Danville, Ill.—The capital stock of the Ridgefarm Electric Light Company at a meeting of the stockholders was increased from $5,000 to $10,000.

Havre, Mont.—The town council held a special meeting a short time ago for the purpose of acting on a petition by the Havre Electric Light, Telephone and Steam Heating Company for a franchise to furnish this town with electric light, etc.

La Crosse, Wis.—At a recent meeting of the city council an ordinance granting the Edison Electric Light & Power Company a 25-year extension of its franchise and a 20-year franchise to the newly incorporated Central Electric Company were passed.

Lawrenceville, N. J.—The people here are endeavoring to have the streets lighted by electricity. A committee composed of N. H. Furman, John Cranstown and Henry W. Green was appointed to investigate the matter and report the result.

Madisonville, O.—The $25,000 bond issue for the improvement and extension of the electric light and waterworks plant at this place was recently made a certainty, the proposition being carried.

Marion, Ala.—This city has recently purchased an 80 hp. engine for the waterworks, and rumor says the city officials are figuring on putting in an electric light plant.

Mayville, N. D.—The electric lighting service is becoming so popular that it is likely an additional dynamo will have to be installed. Peter Sievert can be addressed in relation to same.

McKeesport, Pa.—The question of issuing $150,000 municipal lighting bonds will be voted on at the February election.

Minneapolis, Minn.—A project to make use of the steam power generated by the creamatory, for the purpose of contributing horse power for the operation of a municipal electric lighting plant, is now being discussed by the aldermen who are in favor of such a plant.

Norwood, O.—Bonds are to be issued for the purpose of enlarging the electric light plant of this village. Address W. E. Wiebgar, village clerk.

Rockwood, Tenn.—This city will vote on a proposition to issue $6,000 worth of bonds to complete the electric light plant. Address the mayor.

South Bethlehem, Pa.—A $100,000 electric light plant will shortly be erected here. W. H. Jacobs may be addressed.

Wellington, Kan.—The citizens of this place have voted $15,000 in bonds for the erection of an electric lighting plant.

Woodstown, N. J.—The borough council has decided to accept the proposition of the Ice & Cold Storage Company to furnish electric lights for street lighting at $13.50 per light per annum.

Street Railways.

Belton, Tex.—A franchise has been granted by the council to H. M. Carter, of Dallas, for an electric railroad between Belton and Temple. As soon as the franchise can be secured from Temple work will begin.

Cincinnati, O.—The Cincinnati, Georgetown & Portsmouth will be the first railroad in the United States to exchange its entire motive power from steam to electricity. This road runs from this city to Georgetown, O., a distance of 42 miles. The present company is the successor to the Cincinnati & Portsmouth Railroad. Its capitalization includes $500,000 of authorized stock and $400,000 of funded indebtedness.

Colorado Springs, Col—A petition, which is being signed by hundreds of people in this city, requests the city council to grant the street railway franchise asked for by F. L. Dana and associates.

Flint, Mich.—E. O. Wood and D. D. Aitken of this place are promoting a plan for an electric railway, 11 miles long, between Flint and Flushing.

Georgetown, S. C.—A charter has been issued for an electric railway in this place.

Kansas City, Mo.—The charter for the Kansas City & Olathe electric line was lately granted at Topeka. The charter calls for an electric railroad to be built from either Kansas City, Kan., Argentine or Rosedale to Olathe. The capital is $1,000,000. F. C. Goodwin and T. A. Milton are interested.

Lead, S. D.—The Burlington Railway Company was lately granted a franchise for the building and operating of an electric road through Main street in this city.

Lebanon, Pa.—An electric trolley line from this city to Mt. Gretna is now being talked of.

Massena, N. Y.—The Massena & Raymondville Electric Railroad Company has been formed to operate an electric road from here to Raymondville, with a capital of $80,000. W. J. McKinney, H. H. Warren and W. J. Patch of Massena are the directors.

Milwaukee, Wis.—The Milwaukee Western Consolidated Electric Railway Company, with a capital of $100,000, expandable to $2,000,000, has been incorporated. J. W. Wegner, one of the incorporators, says: "We have a franchise before the common council, which we expect to see passed. When that is once passed, then we will be able to say something of our plans and purposes. We are in earnest."

Mitchellville, Ia.—The people here have voted a franchise and a 3 per cent. tax to the Butler-Coffinberry Syndicate to build an electric line to this place from Des Moines.

New Castle, Ind.—Charles S. Hernly, of this place, is vice-president of the Newcastle, Cadiz, Markleville, Pendleton & Western Railroad Company, which has been incorporated to build an electric line between those places. The road will be 20 miles long, and connection with the Union Traction Company at Pendleton will give Newcastle a short line connection with Indianapolis. The capitalization of the company is $500,000.

Norristown, Pa.—A franchise has been granted by the Newtown borough council to the Newtown & Yardley Electric Railway Company for laying tracks on Washington avenue from State street to the borough line.

Oskaloosa, Ia.—A company was lately organized here to construct an electric road between Tama and Buxton, via this city, to be called the Oskaloosa & Tama Railroad Company. Sam Clark of Oskaloosa was elected president.

Pittsburg, Pa.—The Southern Traction Company, the Suburban Rapid Transit Company and other lines of this city are to be absorbed by the Philadelphia Company. To get complete control of Pittsburg Traction it will increase its bonded debt to $22,000,000 and its capital stock to $36,000,000.

Royersford, Pa.—This town will have a trolley line inside of a year.

Saranac Lake, N. Y.—Paul Smith and Wallace Murray are talking of constructing a trolley line from here to Keene Valley.

Sierra Madre, Cal.—This place has raised the necessary $6,000 to secure a branch of the Pasadena Electric Road.

St. Louis, Mo.—D. C. Taylor, president of the St. Louis, Kirkwood & Manchester Railway Company has applied to the County Court at Clayton for a franchise for an electric line from this city to Manchester.

Trenton, N. J.—The New Jersey & Pennsylvania Traction Company has filed articles of incorporation with the Secretary of State with the object of constructing a street railroad in this city to carry passengers for a three-cent fare.

Upland, Ind.—The town council has granted a franchise to the Eastern Indiana Traction Company.

Washington, D. C.—The Washington Traction Company, which controls all street railways in this city, is to be sold shortly under foreclosure decree of the United States Court.

Woodbridge, N. J.—Steps are being taken by a number of prominent citizens of this place looking to the organization of a trolley company to build a system connecting Perth Amboy with Woodbridge, Port Reading and Carteret. Among them are Judge S. D. Brown, B. L. Drummond, W. J. Lansley and Franklin Moore.

Manufacturing.

Chicago, Ill.—The Electrical Specialty Company, capitalized at $6 500, has been formed by J. J. Neiger, A. Q. Reinolds and J. B. Hutchinson, to manufacture electrical specialties.

Columbus, O.—Articles of incorporation for the Buckeye Arc Lamp Manufacturing Company of this city, were recently sent to Dover, Del., by Josiah Marvel. The company already manufactures incandescent lamps, and now wishes to be chartered to make arc lamps. The capital will be $75,000.

Jasper, Ark.—The E. J. Noblett Company, of Chicago, manufacturers of cabinet work for electrical construction, cross arms, pins, brackets, etc., which consumes an immense amount of fine wood, has decided to locate the factory at this place.

Portland, Me.—The Williams Electric Manufacturing Company was lately organized here for the purpose of dealing in electrical inventions with $500,000 capital stock. The officers are: President Frederick Williams, of Medford, Mass.; treasurer, John W. Brittan, of Weston, Mass.

Company Matters.

Chicago, Ill.—The Western Electric Company was lately granted a permit to erect a 10-story office and factory building to cost $172,000, in connection with its present plant at 277-81 Clinton street.

Marion, Ill.—The Coal Belt Electric Railroad Company has increased its capital stock from $100,000 to $500,000.

Ottawa, Can.—The Consumers' Electric Company, Limited, has obtained a charter.

Racine, Wis.—A meeting of the stockholders of the Racine Fire Engine & Motor Company will shortly be held to increase the capital stock from $50,000 to $150,000.

Richmond, Va.—The Virginia Electrical Railway & Development Company has closed a contract with the Electric Storage Battery Company of Philadelphia for the most approved and up-to-date storage battery plant.

St. Johnsbury, Vt.—The St. Johnsbury Electric Company has increased its capital stock $25,000, making the total $75,000.

Youngstown, O.—The Banner Electric Company, a West Virginia corporation with $35,000 capital stock, has been authorized to do business in this State, with headquarters here. All its capital is used in Ohio. J. E. Lippincott of Alexandria, Ind., is president, and N. L. Norris of this city is secretary.

Power and Transmission.

Denver, Col.—Specifications for one of the largest electric power generating plants in the country were submitted to State Engineer McCune recently for approval. The company contemplating the erection of the plant is composed of Eastern and Colorado capitalists, but has not yet been incorporated, and until the formalities have been gone through with the details of the organization will not be made public. The company will build a $100,000 dam across the Grand River at Windy Gap. The water thus held back, will be carried in pipes nine miles to the top of a bluff below Hot Sulphur Springs and from there will run over the water wheels of the plant, where electric power will be generated. Thence the power will be transmitted by wire to all the mining camps in the vicinity, and to many shops in Leadville. The plant itself will cost $150,000, it is estimated.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, November 25, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	35	37
Broadway and Seventh Avenue	100	247	252
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	167¼	167⅜
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	121	121¼
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	105	106
Brooklyn City Railway	100	241½	242½
Brooklyn Rapid Transit	100	67	67⅛
Baltimore United Railways, com	50	15⅝	15¾
do. do. do. pref	50	91	92
Buffalo Railway	100	99	101
Cleveland City Railway	100	102	102½
Cleveland Electric Railway	100	83	85
Columbus (O.) Street Railway	100	37	38
Jersey City, Hoboken and Paterson	100	19½	20½
New Orleans City Railway, com	100	29	27
do. do. do. do. pref	100	102	106
North Jersey Street Railway	100	23½	25
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	33	36
do. do. do. pref	100	85	86
St. Louis United Railways, com	100	25⅝	26
do. do. do. pref	100	79¾	80¼
United Electric of New Jersey	100	16	18
PHILADELPHIA.			
American Railways	50	40¾	41
Citizens	50	359½	360
Columbus Railway	100	46	48
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	67	67½
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23½	24
do do pref	50	64½	64¾
Dayton Traction	100	156	156½
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151½
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205½
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	97	98
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26⅝	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	28½	28¾
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	163	164
West End Street, com	50	91	92
do. do. do. pref	50	113	115
CHICAGO.			
City Railway	100	185	189
Lake Street Elevated	100	13	13⅛
North Chicago	100	190	200
Union Traction, com	100	12½	13½
do. do. pref	100	51	51¾

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23⅛	23¼
do. do. do. pref	50	64	64¼
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	47	48

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Electric Boat, com	100	19	21
do do pref	100	45	47
Electric Lead Reduction	100	1⅞	2⅛
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	2¼	3
do do pref	100	5	6
General Carriage	100	¾	⅞
General Electric	100	267¾	268
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	241	245
General Electric	100	267½	267¾
Massachusetts Electric Companies, com	100	35¾	36¼
" " " pref	100	94	94¼
Westinghouse Electric & Mfg., com	50	70	70½
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	161	161¼
National Carbon, com	100	19	20
do do pref	100	82	84
PHILADELPHIA.			
Electric Company of America	50	5⅞	6⅛
Electric Storage Battery, com	100	56	59
do do do pref	100	56	59
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	5¼	5⅜
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	92	93
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
BOSTON.			
American Telephone & Telegraph Company	100	161	162
Erie Telegraph & Telephone Company	100	24½	25
New England Telephone Company		133½	134
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co.	100	106	109
Commercial Cable Company	100	175	184
Franklin Telegraph Company	100	47	55
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	120	123
Mexican Telephone Company	100	2	2⅛
New York & New Jersey Telephone Company	100	167	170
Pacific & Atlantic Telegraph	25	78	83
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		91⅜	91½
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	115
Cumberland Telephone & Telegraph Co	50	133¼	133
Chesapeake & Potomac Telephone Company	100	72	75½
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		78	84
Hudson River Telephone Company	100	109	112
Northwestern Telephone Company, guar	50	122	126
Providence (R. I) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Nov. 25

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1⅜	1⅝
Eddy Electric Manufacturing Company	25	8	8¼
Storey General Electric	10	9	12
Consolidated Car Heating	100	55	57
Standard Underground Cable	100	180	190
Pratt and Whitney, pref	100	84	92

STREET RAILWAY BONDS.

	Last Sale.	Int. Paid.
ALBANY.		
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116¼	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116¼	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108¼	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅝@16⅞c.; Lake, 16¾@17c.; casting, 16½@16¾c.

William C. Whitney, it is reported, has been a large buyer of Metropolitan stock around 168.

A consolidation of trolley systems, amounting to 562 miles from Erie, Pa., to Martinsville, Ind., is projected.

The Tacoma Railway & Power Company, of Tacoma, Wash., reports net earnings for October of $11,596, an increase of 116 per cent. over the same month last year.

It is understood that meetings are being held with the object of securing closer relations with the New York and Brooklyn gas and electric light and heating companies.

The directors of the London and River Plate Bank, Limited, London, have declared a dividend of 20 per cent. to the shareholders for the year ending on September 30th last.

It is currently rumored that a stock dividend by the General Electric Company will be deferred until next April, but that it will amount to 66⅔ per cent. A cash dividend of 15 per cent. is also expected.

A Boston dispatch states that the Cumberland Telephone & Telegraph Company reports a net increase of 2,160 subscribers during the month of October, making total number of subscribers November 1, 72,740.

The stockholders' meeting of the Edison Electric Illuminating Company of Boston has again been adjourned to December 4. The gas and electric light commissioners of Massachusetts have authorized the company to issue 7,500 new shares at $200.

Advices from Houghton, Mich., state that considerable machinery has arrived there for Calumet & Hecla's new plant, which will separate copper from the old stamp sands. During the coming winter, thorough experiments will be made to prove whether there is a profit in this operation.

The Mohawk and Hudson Telegraph Company has been incorporated at Albany, N. Y., with a capital of $50,000. It proposes to run wires from Schenectady to Buffalo, New York and Long Island points. Julius M. Zeiser and Joseph Ralph, of Schenectady, are the principal shareholders.

According to a financial daily one of the largest merchandise brokers in the world, who has just returned from a trip abroad, says: "I have studied the metal situation both at home and abroad this summer, and I can reach no other conclusion than that copper at 17c. is the highest priced commodity in the world."

Edwin M. Post, Robert E. Jennings, Leroy W. Baldwin, and Henry Rowley have been requested by a large proportion of the stockholders of the General Carriage Company of New Jersey to present a plan of reorganization. The committee of reorganization has now the sole option to acquire substantially all the old assets of the old company for this purpose, and also additional working capital.

The New York, New Haven and Hartford Railroad Company will discontinue the third rail service between Nantasket Junction and Hull as well as between Cohasset and Hull this winter, steam replacing it. It is probable that the working apparatus will be thoroughly overhauled and that electric service will be resumed next summer,

A dispatch says the street railway system of Savanah, Ga., will pass under the control of the Edison Electric Company of Boston on January 1. The Edison company operates a lighting plant in that city. The two plants are now capitalized at $2,287,000, and the belief is that the new capitalization of both companies will not be more than $3,000,000.

The Washington Traction Company which controls the street railways of Washington, D. C., was sold at Norfolk, Va., on Saturday for $5,000,000 by Special Master Tunstall, under a decree of the United States Court of the Eastern District of Virginia in the case in which the United States Mortgage & Trust Company was complainant. The stocks and bonds were bought in for the reorganization committee.

The Metropolitan Street Railway Company of New York has paid into the city treasury $259,452 for the present year, on account of percentage taxes on receipts and street car license for its various lines. The plans for raising new capital to equip with electricity the Metropolitan lines now operated by horse power will shortly receive consideration. The earning for the September 30 quarter, showing a surplus after dividends of $128,000, are considered very satisfactory in view of the fact that the summer quarter is the poorest of the year, the business then being largely of a long-haul kind.

A financial paper says: "The strength in Manhattan last week was credited to three reports. The first was that an operating company was to be formed which would take control of Manhattan, Metropolitan, Brooklyn Rapid Transit and the Subway Company. People in a position to speak with authority said there might be such a scheme, but that Manhattan was not likely to be a party thereto unless Manhattan could control the operating company. The second report was that Manhattan and New York Central were to enter into alliance, by means of which New York Central passenger traffic would be distributed by Manhattan upon terms very favorable to Manhattan. Nobody connected with either Manhattan of New York Central would confirm this report, although the fact that Manhattan or New York Central moved together was regarded as of some significance.

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EDITORIAL NOTES.

The Slump in Copper. On enormous transactions Amalgamated Copper declined on Saturday to 72¼—the lowest point in its history, and the principal copper stocks in New York and Boston since May have suffered a depreciation in value of over $98,000,000.

Of course there are many rumors about the unprecedent slump, and one is that Henry M. Rogers, president of the Amalgamated Copper Company, had on Friday last completed arrangements for the sale of 55,000,000 pounds of copper at a reduction of two cents a pound for Lake and three cents for Electrolytic copper. Interests not on friendly terms with the Amalgamated Copper Company claim that the other copper companies are making money and will continue to make money with copper selling five cents below the present market price.

A representative of ELECTRICITY was informed by a prominent copper broker yesterday (Tuesday, 11 A.M.) that the latest quotation for Electrolytic copper was 16⅝@16¾ cents.

The advertising columns of the daily papers have been teeming lately with "tips" to buy "coppers," and as a natural consequence there are victims galore. An article in the "Financier" comes in opportune at this time, and should be read and digested by the "lambs who have been shorn." It is headed "Discretionary Trust Victims" and is as follows:

"Human nature remains pretty much the same, despite centuries of intellectual development and progress. There exists in the average mind a lurking infatuation to take wild chances, to match cunning with wit. From the misguided simpleton who backs his opinion relative to the location of the pea under the sharper's shell to the man who bravely stakes his fortune on 'Change, is a very long cry, but after all, the underlying spirit which animates the venture rests on a common basis. It is not avarice, altogether, that leads men to do these things. The idea of gain is often subordinate to a desire to prove to one's self that his judgment is superior—to furnish stimulus for self-applause, as it were. But human nature seems to possess also a most trusting side, a confiding belief in philanthropy, and in the disinterestedness of those who avow occult financial wisdom. On no other theory can we account for the tenacity of life exhibited by the discretionary pool swindle. The discretionary pool is too well-known to require much explanation. It pretends an ability to acquire great profits through secret knowledge of coming events. Granted that this knowledge was absolute, the pool would certainly justify the wildest claims made for it, but since men who know the course of markets are the least confident of what may happen to-morrow, and have made their fortunes only by keeping what little they do know to themselves until they have perfected their plans, it stands to reason that the bucket-shop soothsayer is a liar, or at least a fool in paying the newspapers large sums of money to print his views. The 'Wall Street Journal' in a recent article puts the case so clearly that we cannot do better than to quote an extract from it.

"'People who trade in stocks can set down as a fundamental proposition the fact that any man who claims to know what the market is going to do any more than to say that he thinks this or that will occur as a result of certain specified conditions is unworthy of trust as a broker. Any man who claims that he can take discretionary accounts and habitually make money for his customers is a fraud; first, because he knows when he makes such statements that he cannot do it regularly or with certainty, and, second, because if he could, he would surely trade for himself, and would scorn working for ⅛ commission when he could just as well have the whole amount made.'

"That sums up the argument in a nutshell, but it is a rather sad reflection on human nature to realize that the advice will be wasted. There will be just as many discretionary pools in operation next year as this; the railroads will bring to Jersey City the same familiar processions of rural gentlemen wearing, as per previous instructions, a distinctive badge by means of which they may be singled out by the discharged expert back note engraver who has money to sell at a discount, and there will be no falling off in the patronage accorded those persons, who, while able to guide by clairvoyant powers their confiding visitors to sure business success, are compelled, for some reason or other, to live in cheap lodgings and at a most modest rate. The discretionary pool is bad enough, no doubt, but after all it is a mere representation, a type, of what has been going on for centuries. Some day this world may be too smart to dabble with uncertainties—but that need not trouble those now living."

* * *

A Railway Engineer on Electric Railway Problems.

At the last meeting of the Institution of Electrical Engineers, held in London November 21, the president, Mr. W. Langdon, referred in a general way to the brilliant achievements of electrical scientists, and then proceeded to discuss three subjects, which he declared were clamoring for urgent consideration, namely, the overcrowding of our cities; the advantages of electric traction, and the economical distribution of electrical energy. Mr. Langdon considers that the field for the electrician in the larger towns will be local traffic only, and with this it will scarcely cope. Rather does he incline to the belief that the relief sought will, in larger towns, resolve itself into short suburban lines of railway radiating from one or more centers into the suburban districts, supplemented by a tramway service both in the city and in the suburban district. Speaking as a railway official, Mr. Langdon finds that electric lines are bound to affect railway revenues, and in residential and in pleasure districts it will be most emphasized; but on the other hand, he said, there is reason to believe that, in many districts, it will ultimately bring to the railways as many passengers as in other respects it takes from them.

The president next discussed the prospects of electric traction in its application to railway working. One direction in which he hopes it will do good service is indicated in the following:

"In my official capacity it is not my duty to determine the speed at which trains should travel, but I cannot refrain from expressing my conviction that if it were possible to lessen the enormous difference which now characterizes the speed of passenger and goods trains great advantages would follow. This can only be accomplished by lessening the mass of the goods and mineral trains, and bringing it more under the control of the brake—a result which probably will never be attained under the steam locomotive régime.

It is practicable, he said, to work one class of traffic by electricity, and the other, as at present, by steam units, but it would involve a large increase in both capital and current charges; for the cost of establishing and operating electrical working for passenger traffic would be very little less than it would be if dealing with the entire traffic, and there would still remain the cost attending that portion worked by the steam locomotive. In considering the initiatory stage of replacing the steam by the electric locomotive, the present condition of traffic has to be faced, and the trains dealt with as they are made up for the former type of motor. Assuming it were determined to test the possibilities of electricity on a given section of a line of railway, whatever that section might be—whether terminal or intermediate—the electric motor would require to haul the trains that might reach that section of line as they were handed over from, or required to be carried forward by, the steam locomotive. It would, in fact, have to take the place of the latter, and do its work. Mr. Langdon says that its capabilities to do this under all conditions have not been proved. It is, however, clear that assuming one electric locomotive incapable, there is no reason why two should not be coupled together in the same manner that steam locomotives are coupled. This would be more acceptable to the railway engineer. To impose upon electricity the work to be done, by a section of existing railway, is the only satisfactory way to prove its power to meet its existing conditions. Mr. Langdon referred to the question of higher speeds on railways, and mentioned briefly the Manchester-Liverpool electric mono-rail project, which will compete with three existing steam railways. He asked whether the requisite powers would not have been preferably granted to one of the existing railways—a railway capable of interchange of stock and of connection with other lines—to employ electrical energy as its motive power, had Parliamentary permission been sought. It is frequently said that existing railways will not permit of higher speeds, that their stock is cumbrous, and the system generally unsuitable. This the president holds to be "not proven." All railways have to face the fact that electricity as a motive power is before them, but it is not likely that piecemeal dealing will affect the main issue. The following advice was given to electric railway promoters and engineers:

"To those with whom may rest the privilege of establishing electrically worked lines I would with all respect venture to say: Be careful that you do not retard that great work which sooner or later must invite attention. In the establishment of light high-speed, point-to-point, passenger lines little difficulty may be encountered. It is not, however, with them that the interest of the country needs your aid, so much as in the conversion of those lines which are already established. It is where competition of a fruitless character—fruitless in that it will not prove productive of a return to the shareholder of the new, more than to the shareholder of the old—steps in, that capital will be squandered."

President Langdon discussed the many power distribution schemes which have occupied attention during the past two or three years, asking to what extent these schemes are destined to aid economical manufacture and meet competition in industry, and in the course of his concluding remarks he took up the text of his address to the Glasgow International Engineering Congress, viz., the backwardness of British electrical industry, due to over-legislation and other causes. "What is needed is greater liberty—greater freedom—less restraint. Often do we hear the cry, 'Educate! educate!' but of what avail is education without experience? Are British engineers deficient in education? Do those electrical plants and installations which have been established indicate a want of knowledge? Do they fail to favorably compare with those of a similar character in other countries? Why is it that America has forged ahead in electrical applications in the manner she has? Is it due more to education than to experience? It is experience that has gained for her engineers and manufacturers the position they have attained in the provision of electrical equipment. It is this experience which has enabled them to determine that which is adapted to meet the demands arising out of this new power; to standardize it, and lay downs plants for its manufacture."

Only the Best Wireless System for the Weather Bureau.

The annual report of the Secretary of Agriculture contains some reference to wireless telegraphy in connection with the work of the Weather Bureau. The Secretary says the vast extent of our sea and lake coasts and the intimate communication between the Weather Bureau stations, which are distributed along these coast lines, and the vessels of commerce have induced him to authorize persistent and systematic experimentation in etheric telegraphy. Substantial improvements have been made during the past year in the Department's system. The line of research has been divided into three classes: First, the perfection of a more powerful transmitter, in which the energy of radiation shall be greatly increased; second, the devising of a more delicate receiver—one that would be positive instead of depending upon an imperfect and variable contact, as do all systems now in use; and, third, the perfection of a system of selective telegraphy whereby messages may be differentiated and only the receiver that it is desired shall receive the message may become responsive to the waves of ether.

The first of these problems may be said to have been successfully solved, and a transmitter devised capable of radiating all the energy generated. The second is believed to be nearing a successful solution. The third is thought to be well demonstrated theoretically but has not been fully tested in practice.

The Secretary says that while there is much experimental work yet to be done before the present system is reliable for intership communication, or before any two systems can work within the same field without each rendering the other useless, such progress has been made by the Government experimenters that, with no interference by private systems stations can be successfully operated over at least 150 miles of coast line, and they are now in operation on the North Carolina and Virginia coasts, and soon will be instituted between the Farallones Islands and the mainland and Tatoosh Island and the mainland, on the Pacific Coast.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

The electric coaches on Fifth avenue in this city have caused a transformation scene on the gay thoroughfare, and there is a daily rush to ride in the new stages.

◆

The 44th meeting of the American Society of Mechanical Engineers is now being held at its headquarters in this city. A number of interesting papers will be read. The committee on standardization of dynamcs and engines will also report. A feature will be the dedication of the memorial to Robert Fulton in Trinity Churchyard. The meeting will adjourn on the 6th inst.

◆

A dispatch from London says that "Commander Richardson Clover, the naval attaché of the United States Embassy, when he goes to America two weeks from now will take back for the inspection of the Navy Department yet another invention for controlling torpedoes by wireless telegraphy which he inspected this week. The inventor's experiments show that torpedoes not only can be steered by etheric waves but can be stopped, started, and fired at will by means of this agency."

◆

Dr. William Duane, professor of physics at the Colorado State University at Boulder has been granted a patent for an invention by which a large number of telegraph messages can be sent over one wire at the same time. In the physical laboratory at the university, it is said, he has had as many as 18 circuits working on the same wire and return at the same time. On any of these circuits the Morse instrument can be placed and used exactly as with the single wire now in use. Dr. Duane's invention is based on the principle of synchronizing motors.

◆

It is announced that the large power house of the Manhattan Elevated Railway in New York City at 74th street and East River will be started up on December 15. The company on that day will discard steam and operate its Second avenue division by electricity.

◆

A new electrical device, the invention of the late J. C. Henry of Canon City, Col., is the basis of the organization of the Henry Electrical Company, which has established headquarters in Denver with a capital stock of $1,000,000.

◆

With the commencement of cold weather the officials of the Brooklyn Rapid Transit are serving hot coffee to motormen and conductors running on their cars nights and mornings at the terminals of each road. Capital idea.

◆

The British electrical, engineering and contracting firm of Macartney, McElroy & Co. of this city, has secured a contract from the Ashton Under-Lyne (England) Corporation calling for the supply of the requisite steel poles, bases, section boxes and overhead lines for about 1½ miles of electric tramways, which are about to be constructed by that municipality. It is expected that a good part of the overhead equipment will be purchased in the United States through the New York office of the Macartney-McElroy concern.

◆

The Delany system of rapid telegraphy, having been used for the last three weeks by the Pennsylvania Railroad with success between Philadelphia and Altoona in its general business, an extension of the system to Pittsburg is now being considered. The telegraph operators do not favor the Delany system, but it is expected that when they understand it better they will make no objection. It does not do away with any operators or essentially change their work, but enables the sending of a greater number of messages over a wire in a given time.

◆

News from Sault Ste. Marie, Mich., states that the bleaching plant of the Canadian Electro-Chemical Company, manufacturers of bleaching powders and caustic soda, at Canadian Soo, burned last week. The loss is estimated at $75,000.

◆

George De Groat, letter-carrier of the Morristown, N. J., postoffice, has been allowed eighteen claims by the Patent Office at Washington for a collector's recording mechanism for letter boxes. The device locks the boxes, preventing them being tapped during the night, and by an electrical mechanism connected with the postoffice, much the same as a time lock, permits the carrier to open them at the schedule hours in the morning, at the same time recording the time in the office. A test of the new device will be made in a short time with a view to its adoption by the Government.

◆

Plans for the transformation of the Metropolitan Street Railway lines in this city now operated by horse-power to an electrical equipment have been under consideration by the company for some time. A large number of the directors and leading interests are said to have thought it desirable that the work of transforming the lines to mechanical traction should be undertaken as soon as possible.

◆

New registers, which stamp the number of fares collected by the conductor and also mark them on a slip of cardboard, are being put in all the trolley cars of the New York and Queens County Railway. When the cars reach the terminus the conductor tears off the slip on the side of the register and then has the number of fares collected on the trip. This slip cannot be tampered with in any way by the conductor and has to be turned into the railroad office at the end of the day.

◆

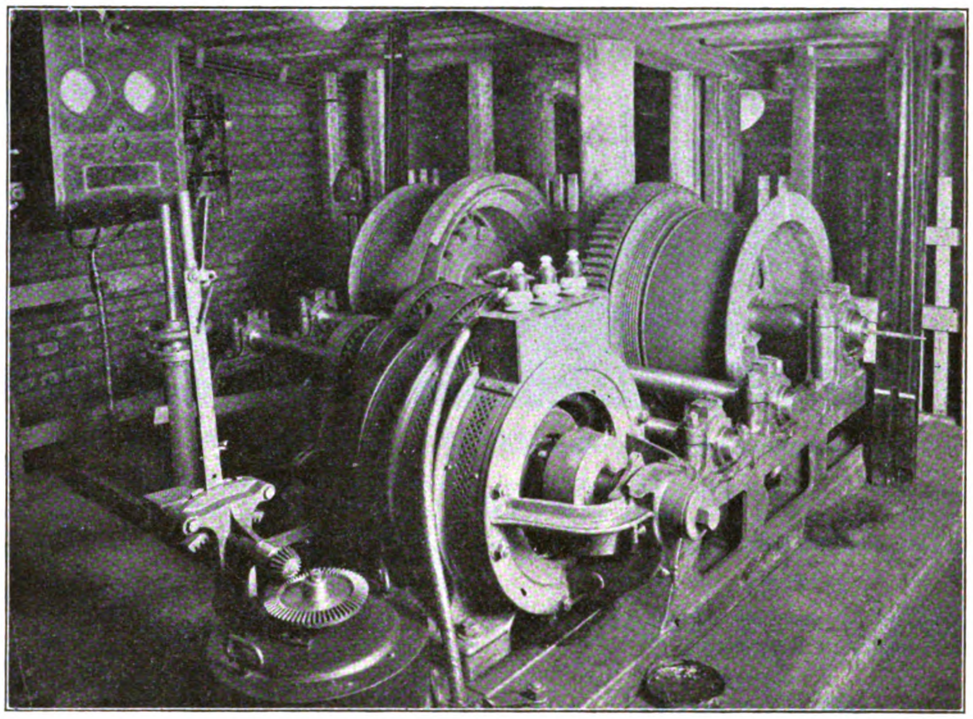
A wireless telegraphic station is to be built in Baltimore, Md., which will communicate with another at Washington. William E. Woodall & Co., ship-builders, have erected an air mast 150 feet in height for the new station, and shipped a similar one to Washington, which will at once be erected. The Atlantic Wireless Telegraph & Telephone Company is installing the plant. The company was incorporated last May, with A. B. Davis of Philadelphia, who is the secretary of the Federal Company, as president, and M. J. Conway, of Baltimore, as general manager. As soon as the buildings are completed the company will make several interesting experiments.

ELECTRICAL COAL MINING ABROAD.

BY FRANK C. PERKINS.

Many of the principal coal mines in Europe are now operated entirely by electrical power and with remarkable success. An instance of this is the polyphase power plant of the Arnimischen coal mine at Planitz, near Zwickau, Germany. The main ventilators for the shafts are driven by polyphase motors, the heavy pumps are driven by alternating motors, direct connected, and the hoisting apparatus and other mining machinery is operated electrically with great economy and satisfaction.

A Siemens & Halske Drehstrom motor is directly coupled to and mounted between the two sections of a double Breslau pump manufactured by the Maschinenbau Anstalt. It is operated at a speed of 145 revolutions per minute at a potential of 500 volts, the pump raising one cubic meter of water per minute to a height of 250 meters. The introduction of polyphase alternating current apparatus in the mines of Europe has been as extensive of late as in the United States, the latest type of electrical mining plant having a central station above ground with high power compound engines direct connected to polyphase generators, feeders consisting of carefully insulated cables conducting the energy down the various shafts to the mining pumps, cutters, ventilators and hoisting windlasses in various parts of the mine.

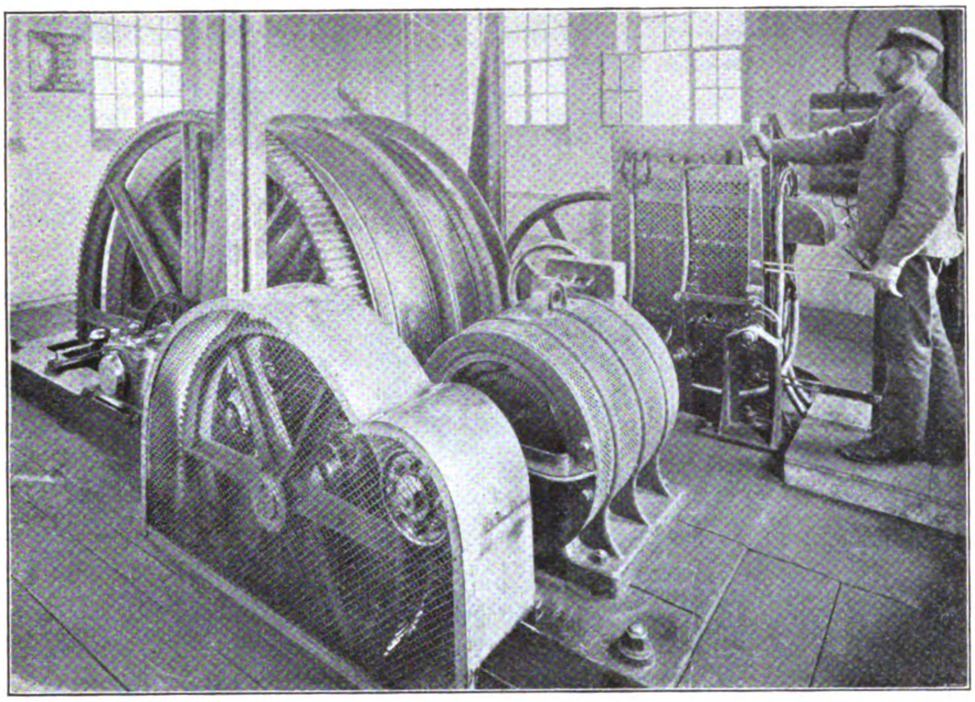


Electrically Operated Windlass at the Arnimischen Coal Mine at Planitz.

The hoisting apparatus connected with a large mine is usually divided into three classes, consisting first, of small electrically operated machines which are used to transfer the materials from the small passages into the large galleries; second, larger windlasses for drawing and raising materials from these points through the larger passages to the bottom of the main shaft; and third, the heavy hoisting apparatus for raising the output through the main shaft to the ground level. The accompanying illustrations show the types of hoisting apparatus as used in the coal mine at Planitz, the smaller outfit being operated by a 20 hp. alternating motor of

Siemens & Halske type, a speed of 1½ meters per second being attained.

The larger hoisting apparatus is that used in the "Heinrich" Shaft, the power being supplied from a 500 volt polyphase circuit to an 80 hp. Siemens & Halske Drehstrom motor. It is conceded by most mining engineers that the alternating current motors of the polyphase type are admirably adapted to mine service, doing away with the more or less troublesome commutator, as they do, and giving a service of great economy, safety and flexibility, while the first cost is no more than other non-electrical means of supplying power.



ELECTRIC HOISTING MACHINE AT THE ARNIMISCHEN COAL MINE AT PLANITZ.

◆

PRINCIPLES OF DYNAMO CONSTRUCTION.—IV.

(Written for ELECTRICITY.)

Calculation of Radiating Surface of an Electro Magnet;

The external surface of a coil has much to do with the determination of its depth and the cross section of wire used. A coil whose external surface is small with respect to the number of turns used, or in other words, a very deeply wound coil would be so limited in its power of radiation that necessarily an accumulation of heat would occur and greatly raise the temperature of the coil above the surrounding air.

There must therefore be some relation existing—such that the proportion of energy wasted in a coil and supplying heat to the surfaces of radiation—that rises of temperature can be predetermined and controlled to limits within our ordinary compass.

Therefore it is at once seen that, as the size of wire used will be dependent upon the radiating surface, the depth of coil winding, the energy wasted in heat and the number of turns, such limits may be determined.

It therefore necessarily follows that if a coil be so proportioned that for every unit of heat developed there be an allowance made of a certain number of units of surface to radiate heat, and this ratio be strictly adhered to throughout, the rise in temperature above a certain limit can never occur.

All heating due to an electric current is measured by $C^2 R$, and the number of units of heat developed in a conductor is proportional to the resistance, the square of the current and to the time the current lasts, or heat units = current squared × resistance × time × constant, or symbolically

$$H = C^2 R t \times .24 = \text{calories}.$$

H = units of heat (heat that will raise 1 gram of water 1° Cent.)

C = current.

R = resistance.

t = time.

$$C^2 R = \text{watts} = \frac{E^2}{R}$$

It can be easily shown that in the case of a body heating by an electric current the product of $C^2 R$ = watts. The material of which a body is composed and its geometrical dimensions determines the rise of temperature. A heavy wire of great length will generate the same amount of heat as a short, thin wire; but having a greater volume of metal to heat does not act to such a perceptible degree.

The finer wire may become hot or incandescent before the heavier wire becomes uncomfortable to the touch.

If W = weight in grams,

S = specific capacity for heat.

θ = rise in temperature Centigrade.

then

$$\theta = .24 \frac{C^2 R t}{S W}$$

Applying the formula in its fullest sense and calling the specific heat of copper .094, we have then if No. 10 B. and S. be considered with a heat waste of 10 watts for one minute.

If W = 100 grams.

S = .094.

θ = degrees Cent.

$C^2 R$ = 10.

$$\theta = .24 \times \frac{10 \times 60}{.094 \times 100}$$

15.32° Cent. or 27.6° Fahr.

It is of course understood that certain modifications would have to be effected in order to more extensively apply this formula for general use; for instance, the rise in temperature for different depths of winding of various gauges would be a matter of necessary investigation also as a factor in determining the current density at which the current would flow. All these conditions in total would help increase or decrease the number of circular mils per ampere in a wire to a point surprisingly above and at times as equally below common practice. The limiting conditions in all cases are a function of the coil surface, or extent and rapidity of radiation, also the amount of metal per unit of energy to be raised in temperature.

A body would rise in temperature if the supply of heat be uniform until it is dissipating as much into the atmosphere and surrounding objects as it is receiving; then its temperature becomes constant.

In general, an allowance of from one square inch to an inch and a half is allowed per watt in a coil to radiate heat.

A square inch of surface heated 1° Fahr. above the surrounding temperature will dissipate the heat of $\frac{1}{225}$ of a watt.

As there are 746 watts to a horse power, each square inch will radiate.

$$\frac{1}{255 \times 746} = \frac{1}{167{,}850} \text{ H.P. at 1° Fahr.}$$

As a general rule all coil windings are in cross sections of copper more than the current requires for its flow. The capacity of the wire is very great for but a small current at times. The EMF. is a factor which greatly affects this state of affairs also; because the current dependent upon the voltage for its very existence, and the size of wire dependent upon the square of the current. the EMF. and size of wire express a relationship which effects an influence upon the length of the wire used if an imposed limit of temperature be resolved upon.

The Atlantic cable, for the passage of but a few amperes at a low voltage, would require a cross section perhaps greater than at present, in order to be of a required ampere length or more exact equivalent of ampere turns.

Should a larger safety factor be used—namely, 1½ square inches per degree Fahr. for radiation—then the horse power emitted as heat energy becomes less, or, $\frac{1}{338}$ of a watt per square inch per degree Fahr.

At this rate the proper proportioning of the winding to prevent any but a definite rise of temperature becomes a matter of absolute surety.

With a certain calculated number of ampere turns and size of wire, which will incidentally necessitate a certain depth of winding, a radiating area follows, which by this rule may be tested as to its rise of temperature. If it be insufficient for the proper and rapid dissipation of heat it must either be increased by the use of more wire or by the reduction of ampere turns by a change in the magnetic circuit.

Silvanus Thompson has developed a table covering the above ground most exhaustively by the application of the formula given by Forbes.

Rise in temperature Fahr. = 225 × watts lost per sq. inch.

To apply this table an example may be cited as given by himself as follows:

Dimensions.					Permissible Amperage, Probable Heating and Permissible Depth.											
					At 1,000 amperes to the square inch.			At 2,000 amperes to the square inch.			At 3,000 amperes to the square inch.			At 4,000 amperes to the square inch.		
S. W. G.	Diameter, inch.	Section square inch bare.	Turns to linear inch covered.	Turns per square inch covered.	A.	F.	D.	A.	F.	D.	A.	F.	D.	A.	F.	D.
22	.028	.00062	23.81	624.	.616	2.28	4.5	1.23	9.12	1.13	1.85	20.52	.50	2.46	36.5	.28
20	.036	.0010	20.00	440.	1.018	3.18	3.9	2.036	12.72	.87	3.05	28.62	.43	4.07	50.9	.24
19	.040	.0012	18.52	377.	1.26	3.56	3.6	2.52	14.24	.92	3.78	32.04	.41	5.04	57.0	.23
18	.048	.0018	16 13	286.	1.81	4.64	3.3	3 62	18.56	.83	5.43	41.76	.37	7.24	74.2	.21
17	.056	.0024	14.28	224.	2.4	5.47	3.2	4.8	21.9	.79	7.2	49.2	.35	9.6	87.5	.19
16	.064	.0032	12 83	181.	3.2	6.57	3.0	6.4	26.3	.74	9.6	59.1	.33	12.8	105.1	.18
15	.072	.0040	11.63	149.	4.0	7.40	2.9	8.0	29.6	.72	12 0	66.6	.32	16.0	118.4	.17
14	.080	.0050	10.64	124.	5.0	8.46	2.8	10.0	33.8	.70	15.0	76.3	.31	20.0	135.4	.17
13	.092	.0060	9.44	98.2	6.6	9.97	2.7	13.2	39.9	.67	19.8	89.7	.30	26.4	159.5	.16
12	.104	.0085	8.48	79.1	8.5	11.53	2.6	17 0	46 1	.65	25.5	103.8	.29	34.0	184.4	.16
11	.116	.0105	7.69	65.0	10.5	12.8	2.5	21.0	51.2	.63	31.5	115.2	.28	42.0	204.8	.16
10	.128	.0128	7.04	54.5	12.8	14.3	2.4	25.6	57.2	.61	38.4	128.7	.27	51.2	228.8	.15
9	.144	.0163	6.33	44 1	16.3	16.4	2.4	32.6	65.6	.60	48.9	147.6	.27	65.2	262.4	.15
8	.160	.0201	5.74	36.3	20.1	18.4	2.3	40.2	73.6	.59	60.3	165.6	.26	80.4	294.4	.15
7	.176	.0243	5.26	30.4	24.3	20.4	2.3	48.6	81.6	.58	72.9	183.6	.26	97.2	326.4	.15
[Stranded.																
7/22	.840	.0043	9.62	101.8	4.3	6.73	4.0	8.6	26.9	.99	12.9	24.6	.44	17.2	107.7	.25
7/20	.108	.0072	7.81	67.1	7.13	8.94	3.7	14.3	35.7	.92	21.4	80.5	.48	28.5	143.0	.23
7/18	.144	.0128	6.09	40.8	12.7	12.4	3.4	25.4	49.6	.83	38.1	111.6	.39	50.8	198.4	.21
7/16	.192	.0229	5.10	28.6	22.9	17.2	3.2	45.8	68.7	.79	68.7	154.5	.35	91.6	274.7	.20
7/15	.216	.0289	4.27	20.1	28.9	19.5	3.1	57.8	78.0	.78	86.7	175.4	.34	115.6	311.8	.20
7/14	.240	.0356	3.87	16.5	35.6	21.8	3.1	71.2	87.1	.76	106.8	195.9	.34	142.4	348.3	.19
7/13	.276	.0462	3.38	12.6	46.2	24.7	3.0	92.4	98.8	.74	138.6	222.3	.33	184.8	395.2	.19
7/12	.312	.0595	3.01	9.97	59.5	28.5	2.9	179.0	114.0	.72	178.5	256.5	.32	238.0	456.0	.18

Figures in columns marked A signify the number of amperes that the wire carries. Figures in columns marked F signify the number of degrees (Fahrenheit) that the coil will warm up if there is only one layer of wire, and on the assumption that the heat is radiated only from the outer surface of the coil; they are calculated by the following modification of Forbes' rule:

Rise in temperature (Fahrenheit degrees) = 225 x number of watts lost per square inch.
= 159 x sectional area x number of turns to one inch — (at 1.000 amperes per square inch).

Figures in column D are the depth in inches to which wire may be wound if 1 watt be lost by each square inch of radiating surface, the outside radiating surface of the coil only being considered.

Rule of calculating a 7-strand cable: Diameter of cable = 1.84 x diameter of equivalent round wire.

Figures under heading "Turns to Linear Inch" are calculated for cotton-covered wires of average thicknesses of coverings used for the different gauges, viz., 14 mils additiona diameter on round wires (from No. 22) and 20 mils on stranded or square wire.

Figures under heading "Turns per Square Inch," as calculated from preceding, allowing 10 per cent. for bedding of layers.

Resistance (ohms) of coil of copper wire, occupying V cubic inches of coil space, and of which the gauge is d mils uncovered and D mils covered, may be approximately calculated by the rule:—

$$\text{(Formula) Ohms} = 960{,}000 \frac{V}{D^2 d^2}$$

A core one inch in diameter requires 2,400 ampere turns with a limiting temperature of not more than 50° Fahrenheit—what volume of coil is necessary if the current is one ampere?

A No. 20 S. W. G. wound one-half an inch deep would give 220 turns per inch length. A coil 11 inches long and a little over one-half an inch deep (or 10 layers) would give 2,400 turns. The table indicates that if this wire carried 1.013 amperes and was wound 3.9 inches deep, 225° Fahrenheit rise of temperature would result. If wound only one-half an inch, about 30° rise would occur, and with but one ampere a little less.

To try the next thinner wire: No. 22 S.W.G. at 2,000 amperes per square inch will carry 1.23 amperes, and heats up at 225° Fahrenheit, if wound 1.13 inches deep. Therefore to heat only 50° F., a winding one quarter of on inch deep or slightly more, to 14 layers, will complete the proper design.

As the depth is 14 layers the length of the coil will be at 24 turns to the inch $\frac{2,000}{14} = 172$ and $\frac{172}{24}$ 7 inches, as there are 2,400 turns and 624 to the square inch $\frac{2,400}{624} = 3.85$ sq. inches of cross section to winding and 26.95 cubic inches of winding.

A formula limiting the maximum current with a temperature of 90° F., never to be exceeded above the atmosphere for the maximum current in a coil is

$$\text{greatest current} = .63\sqrt{\frac{s}{r}}$$

s = sq. inches of surface of coils.
r = resistance of coils.

$$\text{For shunt coils greatest } E = .63\sqrt{s\,r}$$

As an illustration, calling the surface = 28,278 square inches

resistance = .036 ohm.

$$\text{greatest } C = .63\sqrt{\frac{28,278}{.036}} = 17.64 \text{ amperes,}$$

for a coil whose core is 2 inches in diameter, winding one-half an inch deep, length 3 inches and size wire No. 8 B. & S. or 10 S. W. G.

The greatest EMF. can also be calculated, but in this case would be exceedingly small, due to the low resistance of the coil and the limited capacity of the wire;

$$\text{the greatest } E = .63\sqrt{.036 \times 28.278}$$

= .63504 volt, or less than that used for the shunts of platers.

Esson has produced a formula covering the same ground that is worthy of attention.

He employs a constant in his calculations and advises a rise of not more than 70° to 75° Cent. or 126° to 135° Fahr.

FRENCH.

The formula is

$$C^\circ = \frac{W \times 355}{S}$$

C° = Cent. degrees.
S = Cooling surface of coils in sq. cms.
W C^2 R or watts of heat.

If modified to English units of a familiar type we have

ENGLISH.

$$F^\circ = \frac{W \times 102.24}{S^1}$$

F° = Fahr. degrees.
S^1 = Cooling surface in sq. inches.
W = C^2 R.

As an illustration of its applicability, take a coil of the following dimensions wound one-half an inch deep:

EXAMPLE.

Diameter = 3 inches.
Length = 3 inches.
Cylindrical surface = 28.3 sq. inches.
Current = .5 amperes.
Resistance = 100 ohms.

$$\text{Then } F^\circ = \frac{25 \times 102.24}{28.3} = 90.3^\circ \text{ Fahrenheit.}$$

Upon examining such a formula with reference to the preceding—that is to say, an allowance of one or preferably two sq. inches per watt for radiation, it is seen that if the energy consumed in raising one sq. inch 1° Fahr. be calculated for, it will be, if F° = 1 and S = 1.

$$1^\circ = \frac{102.24 \text{ W}}{1 \text{ sq. inch.}}$$

Therefore W or C^2 R must equal $\frac{1}{102}$ of a watt per degree rise in temperature per sq.

inch, or with one watt and one sq. inch an increase of 102.24° Fahr.

Thompson expects a much greater rise than this, as seen below:

Thompson 225° per watt per sq. inch.
Esson 102° " " "

The difference is very striking, and virtually inclines the reader to accept of that with the greatest factor of safety.

With a deep winding, adopting such empirical language, 225° F. will represent per watt more nearly the actual heat than the lesser standard.

Even such an allowance as the above has been increased, so that it is not thought to be extravagant design to allow two sq. inches per watt for radiation.

The temperature to which a coil is exposed must be taken into consideration, as such heat in addition to that developed will be the resultant heat of the coil. For instance, an electromagnet carrying current in a hot engine room must be designed with a heavier wire and more radiating surface than under normal conditions.

NOTES ON THE ALTERNATING CURRENT SYSTEM OF DISTRIBUTION.*

BY W. S. BARSTOW.

Distributing systems are usually referred to under two headings—direct and alternating.

The direct current distributing system, starting in the early '80's and appearing generally in its three-wire form, is what may be termed a universal system, since from the same conductors, and without any modification whatever at the customer's service, current is furnished direct to any electrical apparatus, whether for supply of power, light or heat.

The alternating current distributing system, making its appearance in its single-phase form about the same time as the direct, never started as a means of universal supply, being confined in its earliest stages of development to the furnishing of energy for light and heat only. To the absence of the alternating current motor can probably be traced its restricted use and the early slow progress in this form of current supply. Had there been early developed a single-phase motor which would have met all the conditions of a direct current motor in construction, economy and cost, then there is no doubt but what the three-wire, single-phase alternating current system would have come rapidly to the front. As to whether it would take the place at the present time of large installations of direct current supply, might perhaps be doubtful, since the storage battery as a part of the general system is gaining ground and rapidly becoming indispensable.

The alternating current distributing system was first exploited as a house-to-house supply, and continued as such until within recent years, when efforts were made to interconnect the secondaries to increase the efficiency and reliability of the system. It was soon found, however, that the paralleling of transformers in old systems already erected, through small secondary mains, was much like paralleling compound generators through a small equalizing bus, and many failures were the result. Steps were then taken to install mains of such a size as to make the drop or loss between the two transformers negligible, and for a short time many plants operated successfully with transformers in multiple on fairly long secondary mains. As the demand for current on the mains increased, however, the change in the size of conductors was not followed up, and the old trouble returned. The system to-day, therefore, has almost reverted to a house-to-house supply, although the transformers are arranged in groups, connected to secondary mains, and providing, in case of accident, for interconnection.

The only practical and successful method of paralleling transformers on secondary mains of distribution is the placing of each transformer or bank of transformers on a separate feeder and providing at the station means for regulation on each feeder, so as to make it possible to divide up the load on the different transformers and compensate for any difference in transformer regulation. Such a system is in successful operation in several large plants, and is productive of good results. When the alternating current system is permanently standardized the transformer will no doubt be considered a part of the feeder, only one transformer or bank of transformers being installed at a single distributing point of a single feeder. As before mentioned, owing to the early absence of any commercial single-phase motor, there was no incentive to standardize and develop the alternating system, as has been done in the case of the direct, and it was not until the last few years that the alternating system, by abandonment of the single-phase and the change to multiphase, approached anything like a universal system of supply. Up to the time of the appearance of the multiphase motor the development of motor business on alternating systems was very restricted, as the uses to which the single-phase motor could be put were more or less limited. On the other hand, the introduction of the multiphase motor necessitated a change in the entire system of distribution, and it is not until the last few years that single-phase has entirely given place to multiphase systems, not, in fact, until it became apparent that the multiphase motor, under any stage of development, would prove superior to the single-phase. Probably the simplest multiphase alternating current distributing system which would be first thought of would be the two-phase, three-wire primary and three-wire secondary. Such a system might be satisfactory where light only is used and where the middle wire of the secondary system is always kept of proper size to maintain the balance, but there is no doubt that the better commercial form is the four-wire secondary, or in fact, the two phases taken directly from the machine to the customer's service. With the same number of conductors, a further saving of copper is secured by the use of the four-wire, three-phase. With either of these systems, where transformers are a part of the individual feeder, a complete interconnection of mains can be secured. When the supply from these secondary mains is introduced into the premises of the customer, necessity for installation of additional transforming apparatus arises. If the secondary be of a pressure of 110 volts between phases, either large motors must be installed at this pressure or step-up transformers used. In either case the mains must be very large to take care of this low pressure motor current, and especially when such multiphase motors are frequently stopped and started. If the secondary be of a pressure of 220 volts, the size of conductors can of course be reduced, but it is still necessary to install a transformer or balancing device if 110 volt arc or incandescent lamps are used.

With the object of simplifying the system, in many cases the multiple network of secondary mains has been omitted, and in their place a multiple network of primary mains substituted, the transformers being located on the premises of the customers. This reduces the system to a house-to-house supply and makes necessary the building of vaults or in other ways satisfying the insurance companies, as the full pressure is introduced into the premises of the customer. Such an arrangement necessitates an increase in the transformer capacity of the system, since the capacity of the transformers must be nearer the capacity of the connected load, whereas if grouped and the supply furnished through secondary mains, the transformer capacity can approach nearer the actual maximum load of the system.

In order to reduce the fluctuations of pressure in the lighting circuit, caused by large direct-connected alternating current motors stopping and starting, there have been devised several systems which provide separate means of supply for motors and for lights, by providing additional "power" conductors, but in nearly all cases such systems necessitate the installation of primary transformers on the premises of the customer. With a view of furnishing a single service to the customer without installing apparatus on the premises, there are one or two systems employing four or five low-tension conductors in the secondary, from which different combinations of pressure are secured for the separate operation of motors and lights, but such systems have not been put to extended central station use.

But if the alternating system has not yet attained the standard of a large distributing system for compact territory, it is nevertheless alone in its field of transmission and house-to-house supply in scattered territory, and yet even in these fields too much attention cannot be paid to the consideration of future permanent supply, there being many cases of its having been used as a very temporary means of "getting there." A generator is bought, a few miles of small-sized conductors erected, enough transformer capacity installed to supply present wants, the installation is complete and trouble begins. When extra transformers are required, they are purchased one by one in small sizes and connected to feeders already too small to carry the load. The idea of a change in the size of conductors never occurs, and soon the station manager does not think much of the alternating system, and by that time the public generally agrees with him. This state of conditions is due to the fact that the system has not been designed with an idea of permanency, and the future and uncalculated demand upon it completely destroys its usefulness. Such a state of affairs existed in the pioneer days of direct current engineering, the future demands seldom receiving the consideration which they warranted. Inspectors "determined" the system and visited every corner of the city, every private house, hotel, etc., and finally "determined" that the heaviest direct current mains in the business section should be 27,000 cm.

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*Paper read at the 158th meeting of the American Institute of Electrical Engineers, New York and Chicago, Nov, 22, 1901.

and the feeder 41,000 cm. Three years later, in the same city, these mains were replaced by others of eight times the capacity, and were even then too small. Such was true of the simple direct current system, and it was even more true of the alternating system. The idea that the alternating high-pressure system saves copper, and that therefore it may be possible to save it all, has often brought about a final failure of a promising success.

What is required to-day, however, if the alternating current, besides retaining its field of transmission and scattered distribution where it is supreme, would enter the compact direct-current field of distribution, is:

First.—A standard type of motor, which can be used for all classes of business demands and will meet the same commercial requirements as the present direct-current motor.

Second.—A universal system of supply, which does not require transformers, etc., or anything outside of the meter itself, to be located on the premises of the customers.

Third.—Some apparatus which, in connection with alternating current, will take the place of the storage battery supply on the direct current.

With these requirements complied with, the alternating current distributing systems can expect to take the place of many of the large direct-current systems, not only for the supplying of light, heat and power, but also for transportation.

A NEW FORM OF DIAPHRAGM CELL FOR THE ELECTROLYTIC PRODUCTION OF ALKALIES AND CHLORINE.*

BY JOHN B. C. KERSHAW, F.I.C.

Diaphragm cells for the electrolysis of solutions of sodium or potassium chloride have been patented in the past by many inventors, and at the present moment four types of diaphragm cell are in actual use. The oldest and most successful of these is that operated by the Elektron Company, of Frankfort, since the year 1890. Very few details have been allowed to leak out concerning the construction of this cell, but Haber states that the diaphragms are of cement and that they have a life of two years. The Elektron cell has been widely adopted for the manufacture of alkali and bleach, and there are now eleven electrolytic alkali works in Europe using this type of cell.

The Le Sueur is the next oldest type of diaphragm cell, having been operated at Rumford Falls, in U. S. A., since 1892. The Le Sueur cell is distinguished by a horizontal diaphragm placed in the lower part of the cell. According to Weightman the diaphragms in this cell are constructed of asbestos and last from three to six weeks.

The Le Sueur plant has recently been transferred from Rumford Falls to Berlin Falls, New Haven, (?) where 700 hp. is said to be utilized.

The third type of diaphragm cell is that known as the Hargreaves-Bird. This differs from the two preceding types in the use of an unsubmerged cathode, the diaphragm and cathode being joined together to form the sides of the inner compartment of the cell which contains the electrolyte and anodes. The outer, or cathode compartments of the cell, are filled with steam, and this condensing on the wire gauge cathodes removes the sodium hydrate as it forms. Portland cement and silicate of soda are used to make the diaphragms of this cell, and their life varies from 30 to 50 days—under normal conditions of work. The Hargreaves-Bird cell has been operated at Farnworth, Lancashire, since 1896, and at Middlewich, Cheshire, on a larger scale since the early part of this year.

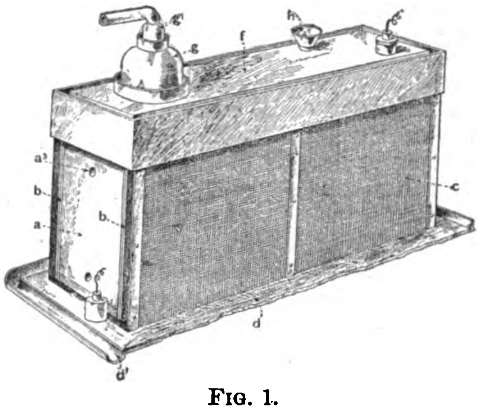

Fig. 1.

The Outhenin-Chalandre is the last type of diaphragm cell to achieve industrial trial. It is the most complicated in design of those in actual use. It will suffice here to say that the diaphragms are made in tube form, and that the cathodes are placed within them, while gravity is utilized to remove the sodium or potassium hydrate as it forms, from the influence of the current. The Outhenin-Chalandre cell is in operation at Chevrés, near Geneva, and in France.

The diaphragm cell about to be described is patented in the names of Moore, Allen, Ridlon and Quincy, all of U. S. A., and the English patent is No. 4,269, of 1900. In many respects it closely resembles the Hargreaves-Bird type of cell, and should the Moore-Allen cell bocome of industrial importance the question of patent validity is almost certain to arise. Fig. 1 is an external view of the cell, Fig. 2 a sectional end elevation. and Fig. 3 a sectional side elevation. The cell consists of two end walls, *a*, *a*, rabbeted at their upper ends to receive two side bars, a^1, a^1, thus leaving the lower part of the sides of the cell open. The ends are secured to a bottom plate a^2; and ends, side bars, and bottom, are preferably constructed of slate. The open sides of the cell are closed by the diaphragm *b*, constructed of asbestos, or some material that will permit free percolation of the electrolyte. On the outside of each diaphragm is the cathode *c*, consisting of several layers of wire-cloth, or of a bed of steel-wool, sufficiently thick to hold solution by capillary action.

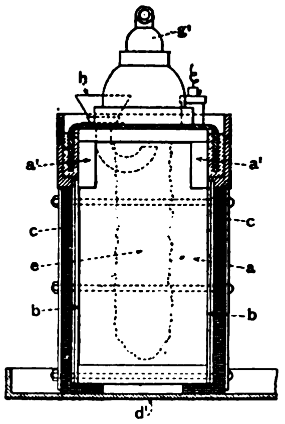

Fig. 2.

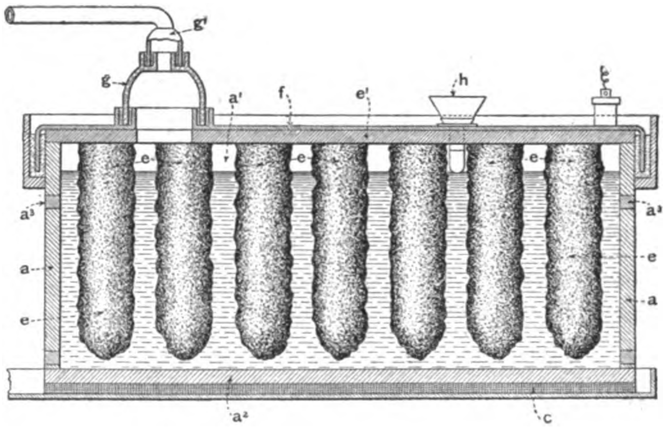

Fig. 3.

The diaphragm and cathode are bent under the bottom plate a^2, and the cathode in this manner makes electrical contact with the iron tray *d*, in which a number of cells stand. This tray serves two purposes—it acts as negative conductor for all the cells standing upon it—and it collects the sodium or potassium hydrate solution dripping from the cathodes. The top of the cell *f* is constructed of lead. The anode consists of a number of blocks of gas carbon, *e*, *e*, cast into a lead plate, e' (see Fig. 3). The chlorine gas liberated at the anode is conducted away through the glass dome *g* and the lead gas pipe g'. The supply of brine to the cell takes place through a pipe a^3 inserted in the end wall, and provision for keeping the electrolyte saturated is made by the use of a funnel trap at *h*. The iron plate *d* is provided with a channel along one side, d', and the solution of sodium or potassium hydrate flowing from a large number of these cells is collected by setting the plate on which they stand in a slightly inclined position.

The advantages claimed for the Moore-Allen cell are that no steam is required to remove the sodium or potassium hydrate from the cathode, that a fairly concentrated solution is obtained containing little undecomposed salt, and that the design and structure of the cell are simplified by dispensing with an inclosed cathode compartment.

The use of the glass dome on the chlorine exit of the cell is said to facilitate the technical oversight of the process, and to lessen the dangers arising from electrical short circuits by the lead of the chlorine collecting pipes.

Advantages one, three and four may, in the writer's opinion, be granted, but it is doubtful whether the second can be substantiated by the results of actual trial.

The wording of the paragraph of the original patent relating to the possibility of producing a solution of caustic alkali containing little chloride, at the cathode, is as follows:—

"As the saline solution percolates through the diaphragm it is held in suspension by capillary attraction in the metallic sponge, free chlorine being given off in the interior of the cell at the anode, and caustic soda being formed in the cathode and on the surface thereof. As previously stated, the electrolyte percolates through the diaphragm, the sodium is set free on the surface of and in the cathode, uniting with the water of the solution to form caustic soda, or sodium hydrate. As the solution of caustic soda and sodium chloride trickles down through the sponge from edge to edge the electrolysis thereof is continued, and the balance of sodium chloride is converted by the water of the undecomposed solution in the pores of the cathode into caustic soda, the chlorine atom migrating through the diaphragm to the anode, and the resultant fluid reaches the plate *d* in the consistency of molasses, and consists of caustic soda and water with a minute percentage of sodium chloride, the sodium chloride, however, being in such small proportion that the solution given off is to all intents and purposes free from it for commercial use."

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*From the "Electrician," London.

Leaving on one side the grammar and chemistry of this paragraph, which are alike open to criticism, the accuracy of the statement that a practically pure solution of sodium hydrate of the consistency of molasses can be obtained at the cathode of the Moore-Allen cell, under normal economical conditions of work, must be questioned.

It has been proved beyond the possibility of doubt that when a solution containing both sodium chloride and the hydrate is used as an electrolyte, the current shows an increasing tendency, as the electrolysis proceeds, to travel by the ions of the latter compound. Before the solution flowing from the cathode of the Moore-Allen cell had arrived at the degree of concentration, described in the above paragraph, the electrical efficiency of the cell would, therefore, have dropped to nearly zero, and the current would simply be decomposing the already formed sodium hydrate. It is for this reason that in all types of cell for the production of caustic alkali, the chief aim of the inventor is to remove the sodium or potassium hydrate as quickly as possible from the influence of the current, and in the type of cell most closely resembling that just described, this removal is effected by inclosing the cathode chamber and by injecting steam.

While, therefore, in some details of its structure the Moore-Allen cell may be regarded as an improvement upon types of diaphragm cell already in actual use, it must be held to be defective in one very essential point. Should the cell ever receive trial upon an industrial scale it will probably be found necessary to accelerate the removal of the caustic alkali from the steel wool cathode, either by a fixed spray of water or by some other means. Under the conditions described in the patent specification, the economic production of caustic alkali by this cell is impossible.

250—500 VOLT THREE-WIRE DISTRIBUTION FOR LIGHTING AND POWER.*

BY PHILIPPO TORCHIO.

In the last few years great improvements have been made in the manufacture and selection of incandescent lamps. The arc lamp practice has undergone a radical change. The wiring and appliances connected with electric installations of buildings and other places have been brought up to a high standard of good workmanship and insulation. These, and other not less important improvements, have made possible the use of commercial voltages considerably higher than were permitted in the early stages of the industry of electric lighting and power distribution.

In existing well-developed systems of low-tension current distribution it would be out of the question to consider at this date the proposition of changing the voltage of the existing systems, but on new installations and in places where changes of systems of distribution are contemplated it is sometimes convenient to adopt the three-wire 500 volt system which has met with great favor abroad and especially in England, and which is gradually being introduced in this country. In its favor are the following points:

The system has all the advantages of the original low-tension Edison three-wire system, and it has greater capabilities of expansion in lightly loaded or scattered territories, as is often the case in small cities or in large factories and other places. The system is economical to operate; it is economical as to distribution within a wide radius; it is flexible and easy of control and simple of operation, and free from such troubles as capacity and inductive effects, which appear on A.C. transmission lines and translating devices; it can be applied directly to a greater variety of services than any other system, and finally, it derives from the use of the storage battery economical advantages in station investment and the invaluable commercial superiority of insuring continuity of service.

The generating equipment and the station apparatus for 500 volt systems is just as well developed as any other apparatus on the market, and the cost is well in line with other standard apparatus.

The main unfavorable points of the 500 volt three-wire system are (a) the increased tendency to arc, necessitating the use of wiring and appliances of high insulation and carefully separated terminals at the customers' installation, (b) the lower efficiency of the 250 volt incandescent lamps as compared with lamps of half that voltage, (c) the difficulty of operating 250 volt arc lamps.

These limitations are gradually becoming less and less restrictive, as a review of the present conditions will demonstrate.

As to the insulation requirements for wiring end appliances, the new rules of the National Board of Underwriters prescribe the same insulation and breakdown test for all wires used with voltages between 0 and 600; all lamp sockets and receptacles must be suitable for use on any voltage up to 250 volts, only rosettes, cleats, knife and snap switches, etc., are required to be special for voltages between 250 and 600. In general, it may be said that any modern installation will safely withstand a 500 volt service, and that the conservative requirements of the Board of Fire Underwriters are not uncommercially stringent. It may, however, be said that not all the local Boards of Fire Underwriters have as yet adopted the rules of the National Board.

In regard to efficiency of high voltage incandescent lamps, the difference for the standard 16 cp. lamp of same candle hour area as the low voltage lamp is about 10 per cent. The best 200—250 volt 16 cp. lamps made at present, have an initial efficiency of 3.4 watts per candle, and have the same life as the 3.1 watt per candle 110—125 volt lamp.

In large cities supplied by Edison system, the common practice is to use lamps of 3.1 watts per candle; in all other places, lower efficiency lamps are ordinarily used, and the 3.6 watts per candle lamp is quite common. In the latter case the adoption of a 3.4-3.5 w.p.c. 250 volt lamp would not materially overtax the user, nor the illuminating company, and therefore, for such places the 500 volt three-wire system would not be at a disadvantage on that account.

The difficulty of adapting arc lamps to the 500 volt three-wire system has been overcome by connecting two ordinary inclosed arc lamps in series in the same manner that the old open arcs were, and are still, in many places, connected on the 110 volt circuits. Lately, however, several types of double arc lamps have been used with entire success. The single arc has also been tried to some extent, but it has proved a failure for general use on account of the objectionable blue light it gives. Such lamps are, however, used for street lighting in a few places.

The review of the difficulties to be overcome shows that they are not very serious, especially for new installations and where changes of distribution are contemplated.

In some calculations recently made to show the economic relations between this system and the ordinary 250 volt three-wire system it was shown that the savings are very large for lightly loaded districts. In Table I (see following page) are given the different assumptions made and steps followed in the calculation, which were as follows:

First column gives density of distribution per foot of street—i.e., watts maximum load per foot of street.

Column (I) gives total length of streets covered by mains per square mile, to which unit are referred all following calculations. The assumption was made that in American cities there are on the average 25 miles of streets built per square mile of territory, exclusive of parks and open places. In the business and crowded sections it was assumed that practically all the streets are covered by mains. In less dense districts only a portion of streets are so covered by mains.

Column (II) gives the maximum load per square mile as obtained from the previous assumptions.

Column (III) shows one layout of feeders which might be representative of common practice for an ordinary 250 volt three-wire system. This is done to arrive at the length of mains to be supplied from each feeding point, as shown in column (VI), assuming conditions given in columns (IV) and (V).

Column (VII A) gives maximum amperes per outlet of mains.

Column (VIII A) gives cross section of each outlet for 1.6 per cent, regulation, assuming its load evenly distributed.

Column (IX A) gives the weight of copper required for mains as determined for the above cross sections.

In column (X A) is given the saving of copper which would be realized if a 500 volt three-wire system had been used instead of the 250 volt three-wire, for same conditions in both instances.

Column (XI A) reduces the copper saving to saving per annum on an assumed basis of cost of copper in case of underground cables, which cost includes a rough estimate of the cost of insulation and lead sheet. In case of overhead lines this saving should have been about one-third less.

In columns (VII B), (VIII B), (IX B), (X B) (XI B) are given on similar lines the calculations of savings for systems operating motors from the lighting mains, assuming to maintain the same regulation of 1.6 per cent. for the specified momentary inrush of current due to motors for each main. This calculation is not accurate, but will not materially offset the relative results under discussion.

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*Paper read at the 158th meeting of the American Institute of Electrical Engineers, New York and Chicago, Nov. 22, 1901.

TABLE I.

	I.		II.		III.		IV.		V.		VI.	VII. A.	VIII. A.
Watts max. load per foot of street covered by mains.	Length of streets covered by mains per square mile.		Maximum load per square mile.		Feeders required for 250 V. 3. W. distrib. with 660 A. density per 1,000,000 C. M.		Average Feeding Points.		No. of Outlets.		Average feet of mains per outlet.	Amperes max. per outlet of mains 250 V. 3. W. distrib.	Average cross section of mains used if no large motors were conn. 250 V. 3 W. 1.6% Regulation — 4 V. over 250 V. c. m.
	Miles.	Feet.	K. W.	Amp. at 250 V.	No.	Average Size C. M.	Per Feeder.	Total.	Per Feeding Point.	Total.			
2.5	12.5	66,000	165	660	4	250,000	3	12	3	36	1,835	18.4	92,500
5	12.5	66,000	330	1,320	4	500,000	3	12	3	36	1,835	36.7	185,000
10	18¾	99,000	990	3,960	12	500,000	2	24	3	72	1,375	55.0	208,000
20	25	132,000	2,640	10,560	24	666,000	1	24	4	96	1,375	110.0	416,000
40	25	132,000	5,280	21,120	32	1,000,000	1	32	4	128	1,030	165.0	468,000
80	25	132,000	10,560	42,240	64	1,000,000	1	64	4	256	515	165.0	234,000

CONTINUED.	IX. A.	X. A.	XI. A.	VII. B.		VIII. B.	IX. B.	X. B.	XI. B.
Watts max. load per foot of street covered by mains.	Lbs. of copper for 3-cable mains 250 V. 3 W. dist.	Lbs. of copper saved if 500 V. 3 W. dist. were used (75% of IX. A.)	Annual saving at 25c. per lb. of copper in Cable and 7% Int. and Dep.	Max. current allowance for large motors connected above normal current of column VII. A.		Average cross section of mains used if large motors were conn. 250 V. 3 W 1.6% Regulation — 4 V. over 250 V. c. m.	Lbs. of copper for 3-cable mains 250 V. 3 W. distrib.	Lbs. of copper saved if 500 V. 3 W. dist. were used (75% of IX. B.)	Annual saving at 25c. per lb. of copper in Cable and 7% Int. and Dep.
				Amps. at 250 V.	K. W.				
2.5	54,945	41,208	$721	18.4	4.6	185,000	109,890	82,416	$1,442
5	109,890	82,416	1,442	18.4	4.6	277,500	164,835	123,624	2,162
10	185,328	138,996	2,432	27.5	6.9	312,000	277,992	208,494	3,648
20	494,208	370,656	6,486	55.0	13.8	624,000	741,312	555,984	9,729
40	555,984	416,988	7,297	82.5	20.6	702,000	833,976	625,482	10,945
80	277,992	208,494	3,648	165.0	41.2	468,000	555,984	416,988	7,297

CONTINUED.	XII.		XIII.	XIV.	XV.	XVI. A.	XVI. B.	XVII.		XVIII.	
Watts max. load per foot of street covered by mains.	Square miles of Territory covered by one distrib. station.		Estimated saving of substation per square mile of 500 V. 3 W.	Annual saving Int. and Dep. at 6% and taxes at 2%	Annual saving of operation per sq mile of 500 V. 3 W	Total annual saving per square mile XI. A. + XIV. + XV. without large motors.	Total annual saving per square mile XI. B. + XIV. + XV. with large motors.	Total K. W. Hours delivered per square mile at the load factor marked.		Total saving per K. W. Hr. delivered.	
	250 V. 3 W.	500 V. 3 W.						L. F.	K. W. Hrs.	Without large motors.	With large motors
2.5	4	16	$6,250	$500	$750	$1,996	$2,717	20%	289,080	.692c	940c
5	4	16	7,812	624	750	2,816	3,537	20%	578,160	.488	.612
10	2	8	15,625	1,248	1,500	5,180	6,396	25%	2,168,100	.239	.295
20	1	4	31,250	2,496	3,000	11,982	15,225	25%	5,781,600	.207	.263
40	.75	3	50,000	4,000	4,000	15,297	18,945	25%	11,563,200	.132	.164
80	.5	2	100,000	8,000	6,000	17,648	21,297	25%	23,126,460	.076	.092

Column (XII) gives an estimate of the territory which can be economically covered by a low-tension station, so as to arrive at the savings of station investment. Only a few years ago, before the introduction of the rotary and inverted rotary converters and composite d.c. and a.c. generators, it would have been impossible to concentrate in one station the production of current for the whole system, and therefore, to study the general problem which we have now under discussion, it would have been necessary to introduce the consideration of building and operating separate l.t. generating stations to cover a certain limited territory. This is no longer the case, as only in comparatively few cases in the lighting situation will it pay to operate more than one generating station, except in the case of very large cities covering hundreds of square miles of territory. Under the present conditions the determination of the number of distributing sub stations is only a matter of balancing the cost of l.t. feeders and other factors entering the cost of distribution against the extra cost at a new sub-station and its operation. Under column (XII) is given a rough approximation of the square miles of territory that could be economically supplied by l.t. sub-stations under given conditions. It will be noticed that with a 500 volt three-wire system a sub-station can in each case supply for same current density in feeders and same regulation a territory four times as large as with a 250 volt three-wire system. Under these conditions, which are approximately the most economical, the amount of copper for feeders will be the same for both systems. There will, therefore, be no saving of copper for feeders in favor of the 500 volt system. While no feeder saving is effected by the 500 volt system, a large saving will be made by the reduction of the number of sub-stations and their operating expenses, which savings per annum are estimated as given in columns (XIV) and (XV).

The following columns (XVI A) and (XVI B) give the sum of all savings, and the last two columns the same, pro-rated to each kw. hour delivered for specified commercial load factors:

In these calculations we have assumed that the station machinery would have the same unit cost per kw. capacity in both systems. The total capacity will be the same in both cases.

TABLE II.

Watts Max. Load per foot of street covered by Mains.	Copper Investment Saving. X. A. No Large Motors.	Copper Investment Saving. X. B. With Large Motors.	Estimated Saving of Sub station. XIII.	Total Investment Saving. A. No Large Motors.	Total Investment Saving. B. With Large Motors.	Total Investment Saving per KW. Max.	
						A. No Large Motors.	B With Large Motors.
2.5	$10,302	$20,604	$6,250	$16,552	$26,854	$100.00	$162.50
5	20,604	30,906	7,812	28,416	38,718	86.00	117.00
10	34,749	52,123	15,625	50,374	67,748	51.00	68.50
20	92,664	138,996	31,250	123,914	170,246	47.00	64.50
40	104,247	156,370	50,000	154,247	206,378	29.20	39.20
80	52,123	104,247	100,000	152,123	204,247	14.40	19.40

We have not taken into account the question of subway ducts, as we have assumed the cost of distributing ducts to be independent of the size of mains. In the case of trunk ducts for feeders we have assumed to require the same number of duct feet in both cases. This will not be the case in actual practice, as while with the two systems we have the same amount of copper to lay in ducts, still in the case of 250 volt system this copper can be better distributed in large cables to fill up the whole duct capacity, while in the case of 500 volt system the copper must be distributed in smaller cables, which cannot be made to utilize as fully the capacity of the ducts. This fact would offset some of the savings for the 500 volt system given in the table.

In the case of overhead lines it has already been noted that the savings for copper would be about one-third less than given in the table. Furthermore, in actual practice the size of 500 volt mains would usually be selected with a more liberal margin than for the 250 volt mains. Therefore, the savings given in table represent the maximum theoretical savings in favor of the 500 volt three-wire system under the specific conditions therein assumed.

These savings are greater in lightly-loaded districts, where we have already stated that, in general, low-efficiency lamps are more suitable. Therefore if the efficiency and life of 200-250 v. lamps are practically the same as for the low voltage lamps, the company can supply the same number of lamps of the two types per kw. capacity of station machinery and distributing feeders and mains; the customer will consume the same amount of current for the same amount of light, and therefore the savings in favor of the 500 v. three-wire system given in the previous table represent actual net savings to the company. If the system has arc lamps and motors connected the saving per kw. hour delivered for those classes of services will also be net savings to the company.

It will be found that in general these conditions are mostly common in the outlying districts of large cities and in the majority of small towns. In many of these cases I think that a 500 v. three-wire system would be entirely successful and present economical advantages. A further advantage in these cases is the relative large saving in investment per kw. added in favor of the 500 v. system over a 250 v. system. This is shown in table (II), obtained from the data of the previous table.

The savings in investment in lightly-loaded districts go up in the hundreds of dollars per kw. load added, and if the district is not expected to reach higher densities it is clear that the advantages of a 500 v. three-wire system are very great, especially if, as is often the case, there is a considerable number of small motors for residence elevators and small factories and shops, but not sufficient to warrant the installation of a separate power circuit to cover such a scattered territory.

In heavier loaded districts the savings are considerably smaller, and represent an insignificant proportion of the total business, as shown in table (I), comparing the total savings of columns (XVI A) and (XVI B) with the total kw. hours sold, as per column (XVII). Besides, in larger systems, it is important to use the most efficient lamp which can be commercially operated, and this further consideration excludes the use of high-voltage lamps, independently of any consideration of the difficulties and expenses involved in the proposition of readjusting to the higher voltage the existing station machinery, storage batteries and switchboard equipments, and also the customers' installations of arc lamps, motors, and a large proportion of wiring and appliances.

The 500 v. three wire system has found a special favor in England, principally on account of the local practice of not supplying customers with free renewal of lamps, which has created a condition where only low efficiency lamps could be operated satisfactorily. Few lamps in England, only three or four years ago, had a higher efficiency than 4 W.P.C. Most lamps in use were old lamps of an efficiency of 5, 6 or 7 W.P.C., and in many cases companies started off with free new 250 v. lamps at 4 W.P.C., giving a positive saving. The 500 v. system has been adopted in several places in this country, among which the most prominent instance is the system of the Narragansett Electric Light Company, of Providence, R. I., operating a 470 v. three-wire system. The experience of this company has unquestionably proved the practicability of the 500 v. three-wire system in small cities and towns under conditions existing in America.

PERSONAL MENTION.

Mr. H. L. Patterson has been appointed purchasing agent for the Crocker-Wheeler Company of Ampere, N. J.

Col. Hoffman Atkinson, vice-president of the Electric Boat Company, which developed the Holland submarine torpedo boat, died November 28 in this city.

Mr. Gong Hee, whose residence is at Portland, Ore., is at St. Paul, Minn., preparing what is said to be the first Chinese work on modern electricity.

Mr. Wm. C. Mitchell of LaFayette, Ind., has been elected president of the proposed LaFayette-Indianapolis electric line, with Robert A. Clark, of Colfax, vice-president; A. Orth Behn, of LaFayette, secretary, and Henry A. Taylor, of LaFayette, treasurer.

INCORPORATIONS.

The Lovercombe Gas & Electric Company, Cincinnati, O. Capital stock, $10,000.

The Duluth General Electric Company, Duluth, Minn. Capital stock, $100,000. Incorporators: A. W. Hartman, R. B. Knox, C. E. Van Bergen, O. C. Partman, of Duluth, and R. R. Dunn, of St. Paul.

The Shenandoah Electric Light & Power Company, Charleston, W. Va. Daniel Annan of Cumberland is one of the incorporators.

The Acme Electric Works, Des Moines, Ia. Capital stock, $5,000. Officers: Joe Gass, president; J. A. Brownfield, treasurer, and James E. Miller, secretary.

The Electric Railway Publishing Company, Detroit, Mich. Capital stock, $6,000. Shareholders: Albert H. Stanley, C. B. King, Joseph Bampton, A, Eastman, George W. Parker and Albert H. Stanley, trustee.

The Union Electrical Supply Company, New York City. Capital stock, $10,000. Directors: E. E. Westervelt and A. F. Westervelt, of Hackensack, N. J., and G. M. Johnson, of New York City.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED NOV. 26, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

687,195. System of Train Control. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 24, 1901.

687,297. Electric Releasing Apparatus for Pneumatic Pressure Brakes. August Bruggemann, Breslau, Germany, assignor to the Deutsche Waffen und Munitionsfabriken, Carlsruhe in Baden, Germany. Filed Aug. 2, 1900.

687,452. Trolley. George E. Chapman and George L. Ensign, Cleveland O. Filed Feb. 20, 1901.

687,475. Electric-Railway Switch. Walram S. Browne, Brooklyn, N. Y. Filed June 2, 1898.

687,507. Car-Fender. Mathew H. Van Dinter, Detroit, Mich., assignor of one half to George W. Kaltz, same place. Filed May 27, 1901.

687,522. Electric Railway. Frederick C. Esmond, New York City, assignor to the Esmond Electric Traction Company of New York. Filed Feb. 21, 1898.

687,561. Trolley-Mounting. Fred C. Greene, Lynn, Mass., assignor of one-half to Minot Kendall, Melrose Highlands, Mass., and George A. Dillingham, Cambridge, Mass. Filed March 21, 1901.

687,622, Railway-Brake. Alfred Green, Rochester, N. Y., assignor to the Compound Brake Company. Filed May 14, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

687,301. Globe or Shade for Incandescent Electric Lights. John C. Fleming, Summit, N. J. Filed Dec 8, 1900.

687,695. Electric Lamp. Karl Ochs, Berlin, Germany, assignor to the Allgemeine Elektricitats Gesellschaft, Berlin, Germany. Filed March 21, 1899.

ELECTRICAL MACHINERY AND APPARATUS.

687,189. System of Motor Control. William S. Andrews, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed July 25, 1901.

687,222. System of Motor Control. Alexander S. Garfield and Carlos E. d'Ornellas, Paris, France, assignors to the General Electric Company of New York. Filed July 27, 1901.

687,261. Motor-Control System. William B. Potter, Schenectady, N.Y., assignor to the General Electric Company of New York. Filed June 15, 1901.

687,422. Electrical Switch. William C. Calkins, Momence, Ill. Filed Feb. 23, 1901.

687,428. Magnetic Mechanical Movement. John O. Heinze, Jr., Revere, Mass., assignor of one-half to William Herbert Rollins, Boston, Mass. Filed June 6, 1901.

687,455. Static Electric Generator. Lawrence Frandsen and Lewis Holzhauer, Sandusky, O. Filed Sept. 20, 1901.

687,569. Rheostat. John Lundie, New York City. Filed Aug. 15, 1901.

687,579. Magnetic Separator. Friedrich A. M. Schiechel, Frankfort on-the-Main, Germany, assignor to the firm of Metallurgische Gesellschaft, A. G., same place. Filed April 26, 1898.

687,615. Electromagnetic Appliance. Anton Duppler, Jersey City, N. J., assignor to the Compound Magnet Brake Company of New Jersey. Filed March 25, 1901.

687,616. Electromagnet and Brake-Operating Connection. Anton Duppler, Jersey City, N. J., assignor to the Compound Magnet Brake Company of New Jersey. Filed April 30, 1901.

687,669. Electrical Snap-Switch George B. Thomas, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing Company, same place. Filed Sept. 3, 1901.

687,690. Electromechanical Actuating Device for Electric Switches, Valves, etc. Edward N. Lake, Chicago, Ill., assignor to the General Incandescent Arc Light Company of New York. Filed June 20, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

687,499. Telephone-Transmitter. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard & Supply Company, same place. Filed March 22, 1901.

687,682. Telephonic Apparatus. Merritt Gally, Brooklyn, N. Y. Filed Sept. 16, 1901.

MISCELLANEOUS.

687,200. Pole for Telegraphs, etc George V. A. Conger, Belleville, N. J., assignor to the Electric Tripartite Steel Pole Company. Filed Nov. 14, 1900.

687,230. Insulator-Support. Thomas E. Hallett, Chicago, Ill. Filed Sept. 7, 1901.

687,234. Resophone for Telegraph Instruments. Francis W. Inden, Duluth, Minn. Filed Jan. 26, 1901.

687,292. Power-Transmitting Device. Charles G. Armstrong, Chicago, Ill., assignor of one-half to David B. Carse, same place. Filed Sept. 6, 1900.

687,440. Wireless Telegraphy. Harry Shoemaker, Philadelphia, Pa., assignor of one half to Gustave P. Gehring, same place. Filed June 10, 1901.

687,457. Electrode. Luke Hargreaves and William Stubbs, Farnworth in-Widnes, Eng. Original application filed June 17, 1899. Divided and this applicatian filed July 5, 1900.

687,474. Means for Transmitting Power. Henry Broberg, New York City. Filed June 22, 1901.

687,479. Electric Winding Clock. William H. Hill, Chicago, Ill. Filed March 15, 1901.

687,505. Electric Furnace. Marcus Ruthenburg, Philadelphia, Pa. Filed Feb. 19, 1901.

687,517. Insulated Electric Conductor and Process of Making Same. Wallace S. Clark and George H. Rupley, Schenectady, N. Y., assignors to the General Electric Company of New York. Filed Dec. 15, 1899.

687,518. Apparatus for Coating Wire or Electric Conductors. Wallace S. Clark and George H. Rupley, Schenectady, N.Y., assignors to the General Electric Company of New York. Original application filed Dec. 15, 1899. Divided and this application filed Dec. 28, 1900.

687,531. Insulating Material. Charles W. Jefferson, Schenectady, N.Y., assignor to the Mica Insulator Company. Filed Feb. 7, 1901.

687,532. Method of Making Insulating Material. Charles W. Jefferson, Schenectady, N. Y., assignor to the Mica Insulator Company. Filed Feb. 7, 1901.

687,576. Electrical Protector. Charles A. Rolfe, Chicago, Ill., assignor to the Rolfe Electric Company, same place. Filed Dec. 1, 1899.

687,588. Steering Mechanism for Automobiles. Elihu Thomson, Swampscott, Mass. Filed March 28, 1900.

687,591. Power-Transmitting Mechanism. Arthur F. Bardwell, Mount Vernon, N. Y. Filed Dec. 19, 1900.

687,599. Apparatus for Control of Automobiles. Eugene Brillie, Paris, France. Filed March 31, 1899.

687,623. Electric Transmission of Power. Joseph B. Hall, Chicago, Ill. Filed Feb. 1, 1901.

687,648. Electric Sparking Plug. Israel C. Orswell, bridgeport, Mass. Filed Jan. 3, 1901.

687,667. Running Gear for Automobiles. Elijah F. Steele, Wallingford, Conn. Filed May 4, 1901.

687,681. Electrical Apparatus. Merritt Gally, Brooklyn, N. Y. Filed Sept. 9, 1901.

DESIGNS.

35,326. Electric Lamp. Charles Murray and Frank Fleury, Springfield, Ill. Filed Oct. 5, 1901. Term of patent 14 years.

35,334. Contact-Post for Electric Switches. Horace E Nichols, Whitesboro, N. Y. Filed Oct. 24, 1901. Term of patent 7 years.

REISSUE.

11,952. Wireless Telegraph System. Harry Shoemaker, Philadelphia, Pa., assignor of one-half to Marie V. Gehring, same place. Filed June 12, 1901. Original No. 671,782, dated April 9, 1901.

THE TELEPHONE WORLD.

Competition for Bell Company.

At a recent meeting of the stockholders of the Kansas Long Distance Telephone Company, held at Fort Scott, it was decided to extend the lines of the company to Kansas City, Mo., and connect with the independent exchange to be put in there by the Kinloch people. The line will be extended from Ottawa or Paola and the improvemets will cost $20,000. This will be the connecting link for an area of 100 miles square over Eastern Kansas.

The stockholders are also contemplating building an extension to Wichita and connect with the independent exchange, a franchise for which was recently granted to Frank L. Brown, a stockholder in the long-distance company.

The management says it will make hot competition for the Bell Company.

Several weeks ago the Belmont Telephone Company of Bridgeport, O., made an agreement with the independent telephone company doing business in Bellaire in that State for the use of its lines. The connections were to have been made immediately, but inability to get the poles, prevented work from starting. The company had poles in Wheeling, W. Va., but could not get cars to load them on. They have been shipped over the river, and distributed along the line from Bellaire to Bridgeport. Inside of two months the Bellaire system will have connection with the National system in Wheeling, and the Belmont over the river. Next spring the entire Bellaire system will be rebuilt.

The Diamond State Company, which now controls all the telephone lines on the Eastern Shore of Maryland, is about completing a line from Port Deposit to Rising Sun by way of Rowlandville, Farmington and Colora. Communication with those towns will shortly be had. The work of putting down the Diamond State Telephone Company's cable across the Chesapeake Bay, between Love Point and the Anne Arundel shore, is still not completed. The cable has broken several times.

The citizens of Eagle, Neb., held a mass meeting for the purpose of talking rural telephone. The Palmyra people have built their line out to within three miles of Eagle, and want the Eagle people to extend a line out to meet theirs and connect the two towns. A committee has been appointed to solicit funds which are to be raised by selling shares at $10 apiece.

The management of the Dauphin County Telephone Company is pushing the construction of the plant to completion, and expects it to be in operation on Christmas day when the familiar "hello" will be heard for the first time in the city of Harrisburg, Pa., upon an independent telephone line. The underground conduit work has all been completed and the cables are now being drawn in at the rate of from 3,000 to 5,000 feet per day.

A local telephone company has been organized at Dayton, Ia., and will be a much needed benefit to the city. About $2,000 has been subscribed and over sixty 'phones have been ordered. The work of putting in poles and stringing wire will be started as soon as help can be obtained. The company will connect with the Martin and Ft. Dodge system and thereby give the local residents good service throughout the county.

The new telephone company, according to the latest reports, expects to have its Austin, Tex., exchange in partial working order within the next few weeks. Many of the lines have already been placed in position and the exchange is about ready for occupancy, so that the system will be partially installed at least by the middle of this month if not sooner.

A union has been completed in telephone circles in Addison, Vt., and locality, which will greatly improve the service in that section, and will make divisions of territory which will not interfere with the operation of any of the systems represented.

The Citizens' Telephone Company has almost reached the village of Vernon Centre, Minn., from the north and the Farmers' Telephone Company has completed its line from the south.

The Rome, N. Y., Home Telephone Company is making some extended improvements in its excellent service there. Men are working night and day putting in additional cables each containing 100 pairs of wires.

The new branch of the United Telephone & Telegraph Company, which brings Williamsport and Sunbury, Pa., into direct communication, was lately completed.

The Streator Independent Telephone Company of Streator, Ill., has increased its capital from $40,000 to $100,000.

An Ohio Telephone Combination.

Stockholders and officials of six of the largest and most successfully operated telephone companies of Northern Ohio met at the Wales House, Lake Punderson, a short time ago, and formed a telephone organization in opposition to the Bell Company. The organization formed is known as the Geauga County Telephone Association, and it comprises the Chardon Telephone Company, the Chagrin Falls Telephone Company, the Stafford Telephone Company, the Bainbridge Telephone Company and the Burton Telephone Company. The organization was effected for the purpose of more effectually opposing the Bell Telephone Company and affording its members mutual protection.

Charles Post, of Bainbridge Township, was elected president and H. C. Tuttle, of Burton, secretary.

This effectually consolidates the largest suburban independent organization of telephone companies in existence, thereby giving the independent home companies absolute control of Eastern Cuyahoga County, all of Geauga, Northern Portage County, and lines will be completed through northern Summit County before winter. This gives subscribers of any and all of the named companies use of about 1,500 telephones without toll, and puts all the important towns of Northern Ohio in direct communication.

Forty Dickinson County, Kan., farm homes have direct telephone connection with each other and with all the towns in the county over the Independent telephone lines, says a dispatch from Abilene. The extension of the telephone toll lines to the small towns has made the farmers eager to secure the same advantages. The plan on which they are put in makes the telephones of much practical service. At each town the farm houses adjacent are put on a party line. Thus the farmers' families may call up one another without ringing into the station. When connection with the county seat or the merchants is desired the toll line is used. Farm houses pay $1 a month. By spring as many more will be in operation and it probable that in two years 1,000 farm homes can be reached by 'phone from Abilene. With the extension of the rural mail system it places the farmers in close touch with the people of town and adds greatly to their advantages.

The Maryland & Delaware Telegraph & Telephone Company of Wicomico County has been incorporated by the following persons: J. Kemp Stevens, George L. Wallace, Charles E. Stevens, William H. Deweese and Fred R. Owens. The capital stock is $100,000, and the home office is at Salisbury, Md. The directors are John Walter Smith, Walter B. Miller, Thomas H. Bock, Harry A. Richardson, Willam H. Baker, Dupont Walker and Fred R. Owens. The corporation now owns the Salisbury Telephone Company, the Crisfield Company and the controlling interest in the Snow Hill Company. Connection will be made with the Diamond State Telephone Company and with the Eastern Shore Telegraph & Telephone Company, thus connecting almost the entire peninsula. The old plant at Salisbury will be rebuilt at once and the metallic system will be used.

The Missouri & Kansas Telephone Company will build another line from Salina to Kansas City. The one wire now in use is crowded to its capacity, and a second wire is badly needed. The new line is completed to Junction City, and will be finished to Salina by spring. It will be a through line, touching none of the intervening points, thus saving a great many delays on long-distance calls.

The Maryland Telephone Company has a gang of men at work erecting poles and stringing wires at Elkton, Md. The company has almost completed its line from Iron Hill to the Susquehanna River, and when completed communication will be had with Baltimore, Philadelphia and Wilmington. The Maryland Company will cross the Susquehanna River and connect with its line on the Harford shore by erecting towers above Perryville.

The Iowa Telephone Company finds itself under the necessity of spending $50,000 on its Cedar Rapids exchange at once. New poles, new lines, new instruments and a new switchboard, are required if it is to keep pace with the demands of the day. It is not long since the company spent a large sum in rebuilding its Cedar Rapids plant.

The Citizens' Telephone Company of Ashland, Ky., has increased its capital $13,000, and the People's Telephone Company, of Catlettsburg, Ky., increased $6,500.

The long-distance telephone line up the Virginia Peninsula, between Newport News, and Richmond, is now in operation.

The telephone exchange at Bloomfield, Ky., has gone into operation.

People's Telephone Company to Improve Service.

S. B. Claypool, general manager of the People's Home Telephone Company of Birmingham, Ala., states that the patrons of the company will be furnished with new instruments within two months, and the exchange will be equipped with a Stromberg-Carlson switchboard. He says this will insure a quicker service and will do away with the necessity of pushing the button whenever connection is desired with the central office.

The present switchboard has not proved entirely satisfactory, but the company promised the people the best service that could be had, and the work of putting in the new switchbord will begin at once.

Parnassus, Pa., borough officials and the Pittsburg & Allegheny Telephone Company continue their merry war. How long it will last remains for the future to bring forth. As was told in a Pittsburg paper there is a disagreement between the company and borough officials over the stringing of wires. Street Commissioner Barnett, who was arrested on an alleged charge of cutting telephone wires, the information being made by a representative of the company caused a wild sensation when called for a hearing. Commissioner Barnett at the hearing admitted cutting the wires, but said he was carrying out instructions given by the burgess. He was held for court. This statement stirred the officials of the telephone company, who announce that proceedings will be started in a few days against a number of borough officials, the charge being conspiracy.

The Freeport, Ill., Telephone Exchange Company does not seem to fear an opposition line. It held a meeting and re-elected L. Z. Farwell, president; Fred Gund, vice president, and Roy K. Farwell, secretary and treasurer. It also increased the capital stock to $50,000 and will make needed improvements. The company has also reduced the rate for business 'phones to $2 a month, and $1.50 a month for party line 'phones; $1.50 a month for residence 'phones and $1 a month for party line residence 'phones. It is said that the Central Union Telephone Company, which controls all the Bell telephones in that State, with the exception of Cook and Stephenson Counties, has made the Farwells a good offer to buy the Freeport plant, but as yet they have not accepted.

The Western Electric Company has not turned over the new switchboard to the Hartford, Conn., office of the Southern New England Telephone Company, and local manager G. A. French said that there was no prospect of its being used immediately.

The Delaware Atlantic Telegraph & Telephone Company of Wilmington, Del., established a new rate on December 1 on local calls. The rate was cut in half, and five cents is the fee in place of 10 cents, as has been the rule.

G. E. Holden, of the Consolidated Telephone Company, has his headquarters in Carlton, Minn. The company has crews at work at both ends of the line, which is now being built between Minneapolis and Duluth.

A 21-year franchise was lately granted the Green Bay & Lake Michigan Telephone Company, owned by ex-Governor Scofield and A. L. Hutchinson. The line is to extend from Escanaba, Mich., to Milwaukee, Wis.

The Livingston Home Telephone Company has decided to build south as well as west, and will have a line from Howell to Pinckney, Mich,, by the middle of December.

The Nebraska Telephone Company's branch line from St. Paul to Loup City, Neb., by way of Farwell, Dannebrog and Ashton, was lately completed.

The Home Telephone Company of Trenton, N. J., was sold last week by Special Master in Chancery Rutherford B. Coleman to Barker Gummere, Jr., for $20,000.

TELEPHONE INCORPORATIONS.

The Louisville Home Telephone Company, Wilmington, Del.—to construct and operate a telephone system in Louisville, Ky. Capital stock, $1,000,000.

The Ives Telephone Company, Oneonta, N. Y.—to connect Oneonta with Cooperstown and Richfield Springs and Franklin, Delhi and Stamford. Capital stock, $25,000.

The Jasper County Mutual Telephone Company, Newton, Ill. Capital stock, $5,000, Incorporators: William Kilgore, R. S. Hunt and J. L. Forrester.

The Bosworth Telephone Company, Bosworth, Mo. Capital stock, $4,000. Incorporators: W. J. Williams, W. S. Windsor, G. L. Reavis and others.

GENERAL ELECTRICAL NEWS.

Lighting.

Aberdeen, Md.—H. C. Osmond of Havre de Grace, Md., contemplates installing a $6,000 electric light plant at this place.

Ann Arbor, Mich.—It has practically been decided by the University authorities to increase the lighting plant by the addition of a large dynamo, one of greater capacity than of the two machines now in operation.

Biloxi, Miss.—This city will vote December 23 on issuing $40,000 to construct waterworks and an electric light plant. Address the mayor for further information in relation to same.

Bloomfield, Ky.—The people here are agitating the question of electric lights and waterworks.

Branchville, N. J.—There is some talk of extending the electric lighting system from here to Augusta.

Brockville, Ont.—The proposition to issue $50,000 in bonds for improving the municipal gas and electric plant will be decided by vote in June.

Cheraw, S. C.—The Cheraw Door & Sash Company will probably install an electric light plant.

Citronelle, Fla.—An electric light plant is to be erected here. Address the mayor.

Concord, N. C.—D. E. Smith, engineer, is preparing plans for waterworks and an electric light plant.

Delphos, O.—A new electric light company has been granted a franchise here.

Eddyville, Ia.—The city council is again agitating the question of electric lights.

Goldsboro, N. C.—The city has decided to buy the Goldsboro Electric Company's lighting plant at $25,000. Address the mayor for further information in relation to same.

Hennessey, Okla.—An electric light plant is to be established here. J. A. Liddle, mayor.

Holley, N. Y.—The citizens of this village will soon discuss the question of issuing $15,000 in bonds for electric light purposes.

Kimball, S. D.—The business men of this place are agitating the question of the establishment of an electric light plant.

Lake Linden, Mich.—The project of establishing a municipal electric lighting plant is being agitated here.

Lathrop, Mo.—The city council is considering the proposition of putting in city electric lights.

Lawrenceville, Va.—An electric light plant will be erected here. Address the mayor.

Leesburg, Va.—At a special meeting of the Leesburg council a franchise was granted to Beverly Chichester for the erection of poles on the streets of this city by a new electric light company, which will shortly erect a new plant here. This franchise was granted because of the unsatisfactory service of the plant now in operation.

Marshall, Mo.—The citizens of this place will vote December 10 to issue $70,000 in bonds to built waterworks and an electric light plant.

Mobile, Ala.—The electric lighting company of this city has authorized the proposed increase of capital stock to $300,000.

New York City.—The municipal council of Guines, 45 miles southwest of Havana, has voted to award the contract for supplying water and electric light for the town to Hugh J. Reilly of this city.

Onawa, Ia.—A special election is to be held to issue $6,000 in bonds for electric lighting.

Oshkosh, Wis.—Judge Seaman has directed Receiver A. R. E. Thompson of the Oshkosh Electric Light & Power Company to issue $60,000 receiver's certificates to remodel the plant and place 350 new arc lamps throughout the city.

Philippi, W, Va.—The street railway company of which John A. Howard of Wheeling is president, will double the capacity of its electric light plant at a cost of $50,000.

Rockwood, Tenn.—The proposition to issue bonds of this city in the sum of $6,000 for the purpose of finishing, installing and equipping its electric light plant was lately carried.

Stanton, Neb.—The Stanton Electric Light Company has lately been incorporated with a capital stock of $10,000. F. A. Raabe is president, F. L. Sanders vice-president and A. W. Forbes secretary.

Tuscumbia, Ala.—J. M. Hughes has been granted a franchise for the construction of a street railway, waterworks and electric light plant.

Villisca, Ia.—H. N. Lowry of Hitchcock, Tex., has bought the electric plant and will overhaul the entire system.

Walnut Ridge, Ark.—The city council has passed an ordinance for installing municipal waterworks and electric light plant. Address the mayor.

Waldwick, Wis.—An electric light line is being constructed to this place, and farmers are talking of having it tapped to light their houses and barns.

West Palm Beach, Fla.—The establishment of an electric light plant is talked of. President Potter of the council is interested.

Yazoo City, Miss.—The Yazoo Improvement Company will increase its capital stock from $100,000 to $150,000, and issue bonds for $75,000 for the purpose of making improvements to its electric light plant and waterworks.

Street Railways.

Canisteo, N. Y.—Ex-sheriff L. D. Whiting, a resident of Jasper, is now interested in the project of building an electric railway between here and Woodhull.

Canon City, Col.—At a recent meeting of the city council a bill for an ordinance was introduced granting to the Florence Electric Street Railway Company a franchise to build and maintain street car lines in this city.

Cedartown, Ga.—The city council has granted a franchise to C. J. James and others to build an electric railroad on several streets.

Creston, Ia.—A plan is on foot to construct an electric trolley line connecting this city with Des Moines by way of Winterset.

Evansville, Ind.—The Evansville & Princeton Traction Company was lately granted a franchise to enter the city and traverse certain streets.

Gulfport, Miss.—P. A. Dolan has become interested in a plan to build an electric railway in this town and has asked permission for same.

Macomb, Ill.—An electric railway from here to Beardstown, via Industry, Littleton and Rushville is said to be assured in the near future. Hon. William Compton is the chief promoter.

Madison, Wis.—The Luzon Transportation & Improvement Company, whose purpose is to build an electric line in the island of Luzon, is being promoted in this city. The company will be capitalized at $600,000, with the option of increasing it to $5,000,000.

Milwaukee, Wis.—The Northwestern Electric Railway Company, capitalized at $25,000 by C. A. C. McGee. H. F. Cochems, W. J. Scanlan and others, has been incorporated here.

Moundsville, W. Va.—The council at a recent meeting passed an amended right of way for the new citizens' trolley line.

Ossining, N. Y.—The Ossining Electric Railroad will extend its Spring street line down to and around Sparta, thence to the prison, and from there to the railroad station.

Paterson, N. J.—The Hudson River Trolley & Ferry Company is seeking to enter this city with a trolley road from New York. The road is already laid from Fort Lee to Hackensack. The company is going to lay its road mostly through private grounds, so as to facilitate the speed of the cars and make it the shortest route from New York to this city.

Sioux Falls, S. D.—The contract for the construction of the proposed electric railroad between this city and Madison has been awarded to George F. Buck and Capt. E. Hill, Eastern men.

Thurmond, W. Va.—It is stated that the electric railroad proposed between here and McDonald will extend along what is known as Loup Creek Valley. T. G. McKell is the promoter.

Manufacturing.

Bristol, Conn.—A new trolley wheel, invented by H. N. Gale, is to be manufactured here by the Liberty Bell Company.

Davenport, Ia.—It is altogether probable that within a short time the Tri-City Railway Company will add to the manufacturing interests of the tri-cities by establishing in them a shop for the manufacture of its own cars.

Newaygo, Mich.—The Hatch Electric Smelting Company, a concern which manufactures an electric furnace, is planning to move to the city and take advantage of the water power afforded here. The company now has a plant at Green Bay, Wis.

Somerville, Mass.—The factory and storehouse of the New England Electric Manufacturing Company on Gorham street, with a good deal of valuable machinery and a large manufactured stock, ready to be delivered for the holiday trade, was recently destroyed by fire. The loss is $20,000.

Wilmington, Del.—The Standard Light Company of this city has been formed to manufacture and deal in incandescent lights and electrical fittings, with a capital of $500,000.

Company Matters.

Clinton, N. Y.—The annual meeting of the Clinton Electric Company was held last month. Those present were John N. Williamson, president and general manager, Ozone Park, L. I.; Thomas W. Cantwell, vice-president, Albany; Thomas F. McBride, secretary and superintendent; James L. Dempsey, treasurer. These officers were all re-elected. The affairs of the company are in a prosperous condition, and the business is steadily increasing.

Jersey City, N. J.—The annual meeting of the stock holders of the Cahill Electric Typewriter Company was held recently in this city, and the following board of directors was unanimously elected: Ellis Spear, Thaddeus Cahill, James B. Lambie, Theodore J. Mayer, Ralph L. Galt, Thomas W. Smith, John T. Schaaff, Edwin L. Cockrell, Charles H. Schaaff and Nicholas H. Shea, of Washington, and George W. Litterest of Jersey City.

Power and Transmission.

Asheville, N. C.—Ladshaw & Ladshaw, hydraulic engineers, have completed plans and specifications for the W. F. Weaver Power Company for the construction of an electric power plant on the French Broad River at Garman's Bridge, 6 miles from here. The plan calls for a plant to cost $200,000, and for the installation of two 750 kw. three-phase generators of 1,000 horse power each. The power derived will be used for the operation of a cotton mill and electric railroad.

Fort Benton, Mont.—The power plant of the Light & Power Company will be enlarged by the addition of more machinery.

Salt Lake City, Utah.—The Consolidated Railway & Power Company of this city will build a new electric plant on the Jordan River at a cost of $250,000. It will develop 3,000 hp.

San Francisco, Cal.—Two big projects having in view the transmission of electric power from the Sierras to this city are under way. A. B. Thompson, with Charles Lane, the millionaire miner, are back of one venture that contemplates a 35 mile water ditch from the headquarters of the middle fork of the Stanislaus River, to bring water to Murphy's and other places.

Automobiles.

Woodbury, Conn.—The Woodbury Mobile Transit Corporation has filed a certificate of incorporation in the office of the Secretary of State. Its objects are to convey persons and property for hire in stages or other vehicles propelled by electricity, steam, gasoline or other motive power. The incorporators are Arthur D. Warner, Horace D. Curtis, Edward S. Boyd, Floyd Hitchcock and W. C. Dinsley, all residents of Woodbury.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, December 2, 1901.

STREET RAILWAY STOCKS.

NAME.	Par	Last Sale.	
NEW YORK CITY.	value.	Bid.	Asked.
Bleeker Street and Fulton Ferry	100	35	37
Broadway and Seventh Avenue	100	247	252
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	175	185
Dry Dock, East Broadway and Battery	100	120	125
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	164¼	164⅜
Ninth Avenue	100	196	205
Second Avenue	100	212	215
Sixth Avenue	100	175	215
Third Avenue	100	120	120¼
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	102	103
Brooklyn City Railway	100	241½	242½
Brooklyn Rapid Transit	100	62¼	62½
Baltimore United Railways, com	50	15⅜	15½
do. do. do. pref	50	91	92
Buffalo Railway	100	99	101
Cleveland City Railway	100	102	102¼
Cleveland Electric Railway	100	83	85
Columbus (O.) Street Railway	100	37	38
Jersey City, Hoboken and Paterson	100	19½	20½
New Orleans City Railway, com	100	29	27
do. do. do. do. pref	100	102	106
North Jersey Street Railway	100	23½	25
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	33	36
do. do. do. pref	100	85	86
St. Louis United Railways, com	100	25⅞	26
do. do. do. pref	100	79¾	80¼
United Electric of New Jersey	100	16	18
PHILADELPHIA.			
American Railways	50	40¾	41
Citizens	50	359½	360
Columbus Railway	100	46	48
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	67	67¼
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23	23⅛
do do pref	50	64½	64¾
Dayton Traction	100	156	156¼
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151¼
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	97¼	97½
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	306½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	32½	33
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14¼
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	165½	166
West End Street, com	50	94	94¼
do. do. do. pref	50	113½	114
CHICAGO.			
City Railway	100	185	189
Lake Street Elevated	100	11½	11⅝
North Chicago	100	190	200
Union Traction, com	100	10⅞	11
do. do. pref	100	51	51¾

STREET RAILWAY STOCKS.

NAME.	Par	Last Sale.	
PITTSBURG.	Value.	Bid.	Asked.
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23	23⅛
do. do. do. pref	50	64	64¼
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	47	48

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par	Last Sale.	
NEW YORK CITY.	Value.	Bid.	Asked.
Electric Boat, com	100	19	21½
do do pref	100	45	50
Electric Lead Reduction	100	1⅞	2⅛
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	2¾	3¼
do do pref	100	4	5
General Carriage	100	1⅝	1½
General Electric	100	275¼	275½
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	241	245
General Electric	100	275¼	275½
Massachusetts Electric Companies, com	100	35¾	36¼
" " " pref	100	94	94¼
Westinghouse Electric & Mfg., com	50	73	73¼
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	161	161¼
National Carbon, com	100	19	19¼
do do pref	100	82	83
PHILADELPHIA.			
Electric Company of America	50	6⅝	6½
Electric Storage Battery, com	100	64½	65
do do do pref	100	64½	66
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	4½	4⅞
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	195	196
Narragansett Electric Company, Providence	50	92	93
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par	Last Sale.	
BOSTON.	Value.	Bid.	Asked.
American Telephone & Telegraph Company	100	160⅝	161
Erie Telegraph & Telephone Company	100	20¾	21
New England Telephone Company		133½	134
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co.	100	106	109
Commercial Cable Company	100	175	184
Franklin Telegraph Company	100	47	55
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	120	123
Mexican Telephone Company	100	2	2½
New York & New Jersey Telephone Company	100	167	170
Pacific & Atlantic Telegraph	25	78	83
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		91½	91¼
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	113	115
Cumberland Telephone & Telegraph Co	50	133¼	133
Chesapeake & Potomac Telephone Company	100	72	75½
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		78	84
Hudson River Telephone Company	100	100	105
Northwestern Telephone Company, guar	50	122	126
Providence (R. I) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Dec. 2

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1½	2
Eddy Electric Manufacturing Company	25	8	8¼
Storey General Electric	10	9	12
Consolidated Car Heating	100	50	55
Standard Underground Cable	100	180	190
Pratt and Whitney, pref	100	84	92

STREET RAILWAY BONDS.

	Last Sale.	Int. Paid.
ALBANY.		
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	[98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent.	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120½	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117½	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115⅞	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅜@16⅝c.; Lake, 16¾@17c.; casting, 16½@16¾c.

The "Journal of Commerce" estimates the December industrial dividends at over $17,900,000, and at $238,830,633 for this year.

Dividends and interest disbursements at Boston during December will foot up a total of $5,512,525, against $6,150,473 in December, 1900.

The Union Traction Company of Philadelphia will claim exemption from taxation of real estate used for power houses under a State statute.

The Massachusetts Electric Companies has declared a semi-annual dividend of $2 per share, payable January 1 to stock of record December 10.

No immediate distribution of surplus to General Electric stockholders is probable. Consideration of the plan, it is said, has been postponed to June.

The Chicago City Railway Company has declared the regular quarterly dividend of 2¼ per cent., payable December 31. Books close December 14 and reopen December 21.

There is some talk of a probable consolidation of the Marconi wireless telegraph interest in the United States with the American Wireless Telephone and Telegraph Company.

It is said that the gross earnings of the Boston Elevated for the past month will show an increase of about $100,000 over the corresponding month a year ago, about 75 per cent. of which will be net.

All of the railway reports which were submitted Saturday were favorable except Brooklyn Rapid Transit, which showed a decrease in net for October of $56,762 and a decrease from July 1 to October 31 in net of $147,199.

A new point of interest in the Philadelphia market on Saturday was a spirited advance of 4 points in Electric Storage Battery, the stock rising 3½ points without an intervening transaction. There was a rumor of a deal with the General Electric.

The Metropolitan Street Railway Company of New York elected the following directors on Monday: H. H. Vreeland, P. A. B. Widener, W. L. Elkins, Thomas Dolan, D. B. Hasbrouck, Charles E. Warren, H. A. Robinson, Oren Root, Jr., and D. C. Moorehead.

The plan for the reorganization of the Erie Telegraph and Telephone Company, now under consideration, contemplates a $25 assessment on the stock, the payment of the $9,000,000 loan to the Old Colony Trust Company of Boston and the raising of about $12,000,000 for working capital purposes.

The Philadelphia Electric Company through the Brush Electric Light Company, its principal operating company, will secure the contract for the electric lighting in Philadelphia next year, amounting to about $1,000,000. As the Philadelphia Electric Company controls all the electric lighting companies in that city it was the only bidder.

Opposition from the authorities of Princeton University is being encountered by the Johnson trolley syndicate, which is endeavoring to extend its lines between Trenton and Princeton up Witherspoon street to Nassau street, in Princeton. A petition antagonistic to the road, signed by former President Grover Cleveland and other prominent men, has been circulated.

The Worcester Traction Company, which was organized to control the street railway system at Worcester, Mass., was dissolved at a meeting of the stockholders at Newark, N. J., Friday. The capital of the company was $460,000, and was reduced a few months ago to $60,000. The original stock was purchased by a combination of Eastern trolley lines and the balance was wiped out by the dissolution.

Brooklyn Rapid Transit declined Monday on the publication of an interview with H. H. Porter, the chairman of the board of directors, in which many imaginary unfavorable features were brought forward prominently. The statements in particular were to the effect that operations were still in a tangle, and that improvement requirements precluded consideration of dividends for a long period.

The Copper Range Consolidated Company was incorporated at Trenton, N. J., December 2, with a capital stock of $28,500,000. The company is formed to mine and smelt and deal in copper and other ores. The incorporators are John Gordon, Herbert I. Foster, D. A. Childs, Paul T. Draper, Michael L. Sahey, all of Boston; Augustus S. Meeker, Louis B. Daily, K. K. McLaren, C. W. Perkins, all of Jersey City.

The United Railways and Electric Company of Baltimore declared the usual semi-annual dividend of 2 per cent. on its preferred stock. The company also voted to pay the December interest upon the income bonds. It is stated that the earnings of the company for the six months ending November 30 would show a net revenue of $120,000 after deducting operating expenses, fixed charges, dividend on preferred stock and interest on income bonds.

Amalgamated Copper closed on Monday at 73½ on dealings in 135,000 shares. This comparative strength from Saturday's close was due in part to the better feeling in the copper markets abroad, which encouraged some buying here for the long account, and in part to short covering. There was no news of the stock, but from Boston came the announcement that the Boston and Montana Company, recently absorbed by the Amalgamated, had cut its dividend, declaring a quarterly dividend of $5 per share. This is a reduction of $5 from the previous quarterly distribution. No new light was thrown on the raw copper market or the actual selling price of the metal. In some quarters it is asserted that the present price can and will be maintained; in others it is declared that secret sales have lately been made 2 and 3 cents a pound under the quoted price.

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EDITORIAL NOTES.

The Trolley Bow vs. the Fishing Rod Trolley.

In a recent issue of the London "Electrical Engineer" there appears an article from the pen of the well-known writer, Mr. E. Kilburn Scott, which sets forth the advantages of the bow trolley as used exclusively in Germany for trolley cars over the so-called fishing-rod trolley as employed in this country.

Referring to the advantages of the bow trolley, the writer states that one of its best features is that it is impossible for it to jump the trolley wire. He further adds that the number of accidents and stoppages of traffic that can be traced to the fishing-rod pattern of trolley jumping the wires are legion. Mr. Scott says: "It is quite the commonest accident that occurs on a tramway system, and it is just the one accident that in the very nature of things cannot occur when a bow trolley is employed. With a trolley pole there have been cases of injury to passengers through the wheel and its bracket becoming detached, either by working loose in the ordinary way, or receiving a blow against a space wire, or bracket arm, due to the pole jumping the wire. Now with a bow trolley there is nothing to get loose—that is to say, there are none of the pins, bolts, etc., which go to make up a trolley head. Many of the accidents which might occur from time to time on account of trolley wire breaking are traceable to the wrenching and hammering which the overhead fittings receive from the trolley wheel."

Another advantage of the bow, Mr. Scott states, is that the wearing surface with the trolley wire is very considerable and is always changing, so there are practically no reversals to be made. With regard to noise, the writer's opinion is that the bow gives much less noise—at any rate, the hissing noise of the bow is always the same—whereas, as the wheel gets worn it becomes more and more noisy.

Commenting on some experiments made in Germany recently the article says:

"Regarding the picking up of current, it is a matter of interest to know that the result of the experiments in Germany on high-speed traction has shown that the bow is far and away the best method of collecting current. It will collect larger amounts of current and admit of much higher speeds than a wheel contact, and the spring of the bow itself appears to present important advantages over the more rigid wheel construction. Another point of interest is that it is quite easy to have two bows on one car, and so break the trolley wire connections at crossings or complicated places, in much the same way as an electric railway train is worked. To put two trolley poles on one car would be risky and expensive to say the least. In some towns the authorities will not allow trolley wires along some of the main streets, and accumulators are employed, as at Hanover. In such cases it is common practice to have two bows, one to collect current for the motors and the other for the cells."

Although some of the points mentioned by Mr. Scott are excellent, and clearly show the advantages of the bow, still it has not the neat and compact appearance of the trolley pole and wheel as made use of on this side of the Atlantic. Furthermore, we are inclined to believe that the accidents due to the use of the wheel, which the author refers to so frequently, are slightly exaggerated. No doubt the fishing-rod has occasionally caused the breaking of span wires, still one may travel in this country for weeks on a well-equipped interurban trolley system without witnessing any mishaps such as are referred to by our English contemporary.

* * *

Electrical Equipment of the New Ships for the Navy.

The Secretary of the Navy has transmitted to Congress a description of the two new battleships and two armored cruisers recently authorized by Congress. Included in the general description is a description of the electrical features of the vessels. On the battleships the electric generating plant will consist of a suitable number of units, not less than eight nor more than twelve, having a combined total output of 800 kw., each unit to consist of an engine and dynamo on a common bedplate. The means of interior communication include all the usual appliances, such as engine-room telegraphs, telephones, electric bells, etc. Each vessel will be lighted throughout by electric power, will have the usual electric signaling apparatus and will carry six searchlights. All turret guns will be supplied with electric-power vertical hoists.

In the two armored cruisers the electric generating plant will consist of 8 units, each composed of an engine and dynamo on a common bedplate. Four units will have a capacity of 100 kw. each, and four of 50 kw., making the total output 600 kw. The following auxiliaries will be operated by electric power, viz: Turret-turning gear, all ammunition hoists, rammers and elevating gear for 10-inch guns, all blowers for hull ventilation, boat cranes, deck winches, laundry machinery and tools in workshop. The miscellaneous electric fittings on the crusiers will be practically the same as those on the battleships.

* * *

Shall Duty be Assessed on the Pacific Cable Material?

A member of the House of Representatives in Washington is said to have recently called at the Treasury Department to discuss with the Secretary the customs provisions governing the admission of cable material into this country. It was represented that a determination had been reached to begin in the near future to lay a cable between San Francisco and Honolulu. Realizing that American cable makers cannot compete with European cable manufacturers the gentleman in question wished the department to advise him if it were not possible to assess all foreign material to be used in the construction of the cable for the entire distance of nearly three thousand miles under the tariff act. According to established precedents a cable, though material for the entire line may be temporarily landed, is not dutiable when planted beyond the three league limit. Therefore, in laying a cable between San Francisco and Honolulu, a tax could only be levied on that portion of the material used within three leagues of the Pacific Coast and the same distance off the Hawaiian shore.

This appeal, according to the correspondent of a daily paper, has excited an interesting controversy which will in all likelihood ultimately be disposed of by a decision of one of the legal officers of the Treasury Department. The Representative, it is asserted, resolutely affirmed that if the executive authorities eventually discovered no way to impose duty upon all imported cable material used in the entire route, he would bring the matter before Congress. Officials say he strongly intimated that he would introduce a bill in the House providing for the assessment of cable material. He contends that as the cable line will be a connecting link between two points of United States territory, all material used in the line should be assessed. Customs officials maintain that this Government has no right to exact tariff on goods used for submarine purposes beyond the limits of the United States. It is set forth that though copper, gutta percha, insulating stuffs and other material, which are taxed at approximately 45 per cent. ad valorem, might be landed in this country, the articles would not be considered imports, because the big cable ship would start out presently to pay the cable off its stern. Then the mere fact of its having been on an American dock for a temporary period would not place it on the tariff list.

Although we strongly advocate protecting and fostering American industries, still in this case it would seem as though an unnecessary stumbling block was being put in the way of an enterprise which if speedily completed would be many times more valuable to the nation as a whole than the few thousands of dollars which might be assessed as duty. We are badly in need of a Pacific cable and if the necessary material cannot with advantage be procured on this side of the Atlantic, let it be purchased in England or anywhere else, so long as it is purchased and the cable laid. This raising of needless questions and causing unnecessary delay to important enterprises is an unfortunate trait of many of our worthy Representatives.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

The annual meeting of the American Society of Mechanical Engineers, held in this city last week, was well attended and a large number of papers were read and discussed. The final report of the Society's Committee on Standardization of Engines and Dynamos is published in this issue of Electricity.

According to a Pittsburg dispatch it has been decided to put an incandescent electric lighting system on all the passenger equipment service of the Pennsylvania lines west of Pittsburg.

Shanghai, China, is to have an electric traction system. It's Municipal Council has advertised for tenders for the construction and operation of tramways. The Council reserves the right to take over the system after a certain period, to be determined in the near future. Hans Ziegler, said to represent the interests of large British electrical concerns, has been making propositions for several months past with a view to his being granted a franchise, but his suggestions have been rejected. The tramways will be about ten miles long.

At a meeting of the British Ornithologists' Club, held recently, there was exhibited the top of a telegraph pole which had been sent from the Government contractors at Cardiff. It was pierced by a hole about 3 inches in diameter. The damage to the poles in that neighborhood was considerable, says the "Electrician," London, and was done by woodpeckers. Mention was made that some years ago there were complaints of the damage done by woodpeckers to the telegraph poles in Germay. Articles on the subject appeared in the ornithological journals, and eventually the plan of impregnating the wood with chemicals was adopted and was efficacious.

A project for the purpose of equipping Rio de Janeiro with a supply of electric power for industrial and other purposes is on the road to realization, plans having been presented and approved by the municipality. The works are to be completed inside of eighteen months. The motive force is to be hydraulic and will be derived from waterfalls located about 44 miles from Rio.

The Schwarzschild & Sulzberger Company, large meat packers at 45th street and First avenue, are shortly to reconstruct their plant in this city on the plan of their Chicago branch, which has just been completed. The plant will be absolutely fire-proof and operated by electricity.

The promoters of the scheme to develop the water power at Lac du Bonnett, Manitoba, are considering the project of building an electric railway from the city of Winnipeg to that place, at a cost of about $1,000,000.

Monrovia, the capital of the nigger republic of Liberia, on the west coast of Africa, has, we hear, enjoyed for the last five months a public service of telephone. The line and apparatus, which are very primitive, were put up by an enterprising colored gentleman from this country. Besides joining the different Government offices, there are six subscribers, a greater number being debarred from availing themselves of the telephone, it is said, by the high price of subscription, which is equivalent to $60 per annum. The line goes inland for about 20 miles.

Prof. Morrison of Victoria College, Stellenbosch, Cape Colony, addressing the local Philosophical Society recently, caused a sensation by advocating a scheme for utilizing the Orange River Falls to provide electric power for the Cape railways. Prof. Morrison urged the practicability of the scheme, but owing to the huge mileage of the transmission lines the proposal has been received with some incredulity.

The Wayne Works, one of the largest manufacturing establishments of Richmond, Ind., is at present enlarging its plant and will adopt electricity as a motive power. It is one of the first establishments in that State to do away with steam entirely. The electrical machinery is now being put in place.

An inventor of the name of Ziehl, has recently published on the Continent, says the London "Electrical Engineer," some particulars of a device of his by which the speed of a direct-current motor can be varied in wide limits, while the efficiency is only slightly changed. It seems that he has succeeded in accomplishing this by producing a special counter EMF. in the armature, and thereby diminishing the voltage of the current received. Thus, according to the value of the special counter EMF. in the armature, the speed of the direct current motor is varied without influencing the efficiency to any material degree. A special armature winding is required for producing this special counter EMF., and this consists of several parts, of which any may be made active or inactive in order to adjust the speed of the motor. It would seem that this device differs little from a double-wound armature with a series-parallel control.

Signor Marconi, the inventor of wireless telegraphy, arrived at St. John's, N. F., December 6. He was accompanied by two assistants, and brought two portable balloons, which will be employed in suspending the wires used in making the experiments. Signor Marconi will probably select the signal hill overlooking St. John's which is topped with the Cabot Memorial Tower, and is 600 feet high, as a site for his station, instead of Cape Race, as previously reported. He expects to transmit messages 400 miles, reaching ships in midocean. He will spend three or four weeks in experimenting there, and then proceed to Nantucket, where he will continue his tests. The Colonial Government will afford every facility to Signor Marconi in his experiments.

◆

News from Washington, D. C. states that the ancient practice of clapping the hands to summon a page has passed away from the House of Representatives. Electric annunciators are now in use. There is one at the back of the Republican side and another behind the Democratic side. When a member pushes a button a small red disk appears in the annunciator, bearing a number which shows where the page is wanted.

◆

An electric stamping machine is being installed in the postoffice at Corsicana, Tex.

◆

Electricity seems a more likely means of discharging rain-clouds than the use of explosives in the upper atmosphere. The experiment is reported to have been made in Japan with success. Trials were made in the Fukushima prefecture. "Operations were commenced at 11 p. m., but there was no sign of atmospheric change until 9 o'clock next morning, when a cluster of clouds were observed over the hill on which the experiment was held. At length rain began to fall, followed by a second fall at 11 a. m., and afterward a third, fourth, and fifth—the last being about 9:30 p. m.; and an area extending over many miles derived benefit from the rain which had not fallen on that part for some time."

◆

The electrical plant at the St. Louis World's Fair will be twice as large as any ever seen at an exposition in this country, and larger than any ever provided at an exposition anywhere. A plant of at least 30,000 hp. is contemplated, and work upon it has begun. The most attractive use of the lights will probably be in connection with the cascades. It is expected to introduce an entirely novel effect, and one which at the same time will be in conformity to the other features of the Exposition. Back of the cascades powerful electric lights will be introduced, which will illuminate the broad sheets of water and make them visible at night from fully half the points on the grounds. The idea of throwing powerful lights on cascades and fountains from the outside has been carried into effect before with pleasing results, but the visibility of the mechanism destroyed the illusion.

◆

The largest induction coil, which produces the longest spark for service in wireless telegraphy, is said to be the one which was recently made for flashing messages between the coast of Japan and Korea. It can produce, in fact, a miniature streak of lightning 45 inches in length, capable of killing any number of persons who might get in its way, and when in operation sends out tremendous thunder rolls. The entire apparatus weighs about 2,000 pounds. A large amount, or 1,320,000 feet of copper wire, was used in its construction, and with a proper receiving apparatus wireless messages should be sent across a space of 500 miles. This immense coil requires about one horse-power of electrical energy for the perfect transmission of wireless waves, which are picked up by the "electric eye" of the receiver.

NOTES ON PRACTICAL ELECTRICAL INSTRUMENT MAKING.[*]

BY JOHN C. BAGOT.

The working instrument makers, generally speaking, though they have the inclination, seldom have the necessary leisure at their command to enable them to go very deep into the theory which forms the basis of those instruments they are from time to time called upon to construct. Consequently many of the little details, "perhaps of the greatest importance as far as the successful working of the instrument is concerned," appears to them at the time unnecessary. Thus very indifferent attention is given them, because their utility is not seen, whilst if it is seen, the importance of it is not recognized, and in many cases the men feel as though working against their own convictions. The assertion is often made that they have no right to their convictions, but the best results are not brought about by the workman who merely follows instructions without any interest in the matter whatever. But rather when he is so assisted as to become acquainted with the particular effect that has to be produced, then he can to a certain extent apply his own ingenuity and ability to the best advantage in manufacturing the cause. It is to the removal of some of these difficulties that special attention will be given in these notes, always as far as possible from a practical point of view, there being already a good supply of literature on amateur work in this direction. Nevertheless, there are many points in such works that the practical instrument maker will find of great service, if for no other purpose than to see that the general utility of an instrument depends very much on the manner it is employed. And seeing the differing circumstances under which the same instrument may be employed, he is at once led up to the principles on which they are based, by the study of which he may not derive any pecuniary advantage, yet will have greater pleasure in his avocation.

The design and mechanism of all electrical instruments are based upon the known effects of the current on various bodies under different circumstances—that is, the magnetic, chemical, and heating effects. To consider the instruments, or these effects in the order of their importance, the magnetic effect would claim first attention, and the first requirement is a simple instrument to detect the presence of the current in a circuit—that is, a simple galvanometer. It will be advantageous to consider at some length the action of the current in this case, for although simple, nevertheless the great majority of instruments depend upon some modification of the same laws. This magnetic effect may be illustrated by the experiment of Oersted by holding a wire carrying a current over a magnetic needle in the direction of its length, the needle being free to move in the azimuth, and capable of coming to rest in the magnetic meridian when not otherwise influenced. Now on holding the wire over this needle the latter will be forced round out of the meridian, and this force depends upon: (I) the strength of the current in the wire; (II) the strength of the magnetic poles of the needle and their distance apart; (III) on the distance between the wire and the magnetic needle. This effect is shown in Fig. 1, the direction of the current being shown by the large arrows, and the deflection of the needle by the curved arrow. Remembering always that the end of the needle which points north is south magnetic, the effect shown is due to the current passing over the needle but once, and if the wire were held underneath the needle with the current still flowing in the same direction, the motion of the needle would now be reversed. Now this action is not due to the conductor itself becoming magnetic, but to the condition assumed by the space immediately round it. The condition of this space is such that if it were possible to suspend a single magnetic pole of either north or south polarity within it, the latter would tend to revolve round the conductor in a direction depending on the polarity and the direction of the current in the conductor.

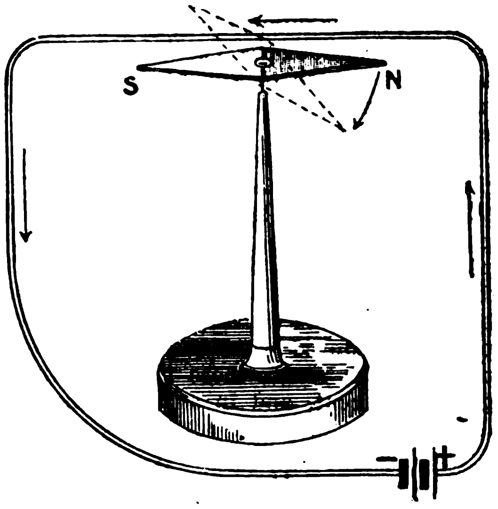

Fig. 1.

An approximate idea of the condition of this space, and the position taken up by a suspended needle, is given in Fig. 2, and it will be seen that the needle sets itself so as to assist the flow of these magnetic lines by turning its greater length in the direction of their flow. Further, the steel being a much better conductor than air for these magnetic lines many become bent out of their natural course so as to pass through the needle, which would not be the case if it was made of brass. This inherent quality is called permeability, thus the action in this simple case depends upon the permeability of the space round the conductor.

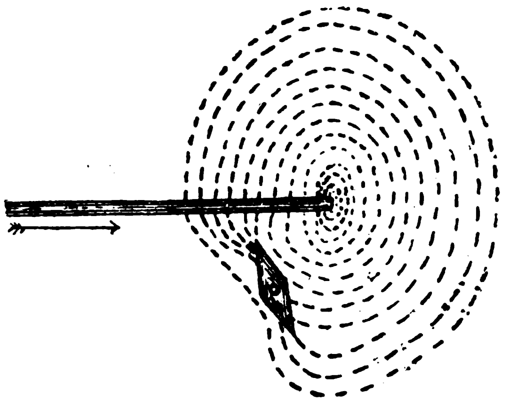

Fig. 2.

Now, it is evident that if this conductor be bent so as to form two parallel conductors, the magnetic lines that are assumed to circulate will coalesce and form a magnetic field of double the strength. So that by coiling the wire many times round the needle, the effect is multiplied almost indefinitely; of course, as the wire is wound on, the mean distance from the needle will become greater, but for practical purposes we may assume that the actual force acting on the needle varies directly with the current, the number of turns, and the mean distance, providing that the magnetic field set up in the coil is at right angles to the magnetic axis of the needle within it. But from a practical point of view this action very much depends upon the nature of the suspension or the quality of the pivoting, for the conditions to be fulfilled in the case of all instruments "where the needles are not controlled by torsion of any kind" is that the needle must return to zero when not influenced by the current.

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[*] From the "Electrical Engineer," London.

It is quite clear that these conditions cannot be fulfilled by blunt-ended pivots rolling about in large holes, not only on account of the greater friction, but also the change in their position in the pivot holes every time they are deflected, and cannot be expected to come back to zero unless the delicacy of the instrument is destroyed by adding weight to the needle, which means more turns of wire or greater current, and in any case not the same effect. The best form of pivot is one that is brought to a point, "but not sharp," and is allowed to rest at the bottom of the pivot holes, the angle of which is made slightly greater than the angle to which the pivot is brought, and when these are allowed to rest at the bottom of the holes almost without endshake, there is practically no friction, and they cannot change their position, which is the cause of the common defect, more especially in telegraph instruments and in the galvanometer under consideration—that is, the magnet coming in contact with the wire inside the coil.

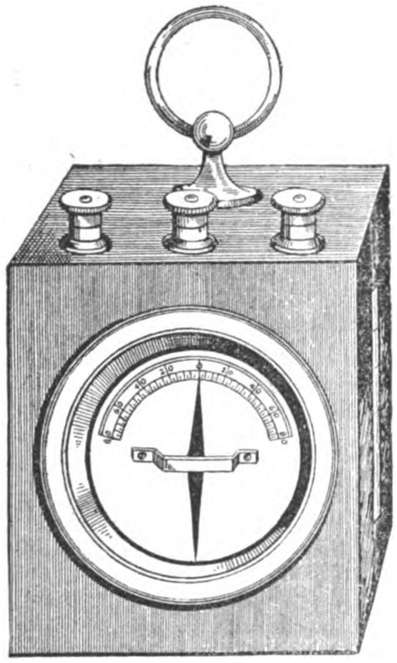

FIG. 3.

The vertical detector complete, with the exception of the glass, is shown in Fig. 3, and and it will be noticed that instead of a simple angle piece a bridge is employed to support the front pivot, which has the advantage of always keeping central, and is in every way better. The deflections, of course, cannot range beyond 80 degrees, but such is not necessary, for even if the instrument should be calibrated so that the deflections were some known value of either EMF. or current, these would be useless beyond 80 degrees, for in this position the magnet inside the coil is almost in the maximum field, so that a current which would deflect the needle, say, 10 degrees from zero would not effect it when at 80 degrees—that is to say, the deflections are not proportional to the current passing through the coils. But with the pivots fitted as described, and only just sufficient weight on the needle to bring it to zero, then the deflections may be expected to be nearly proportional within a range of 55 degrees.

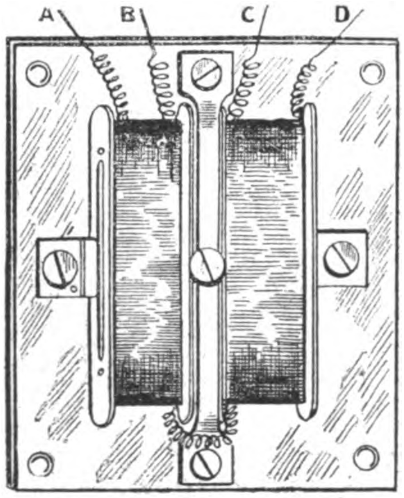

FIG. 4.

The various other points will be sufficiently illustrated by the diagram, and require no further explanation; it will be noticed, however, that there are three terminals. The coils are wound with two sizes of wire, so that the instrument is applicable for the measurement of fairly strong as well as weak currents. The thick wire consists of two layers of No. 18 S.W.G.; the inside end of this wire is soldered to the coil frame, which is of brass, and are in contact when put together. The other ends are brought out as shown in Fig. 4. The thin wire, which should have a resistance of about 400 times as great, is wound on the top with all four ends brought out clear of the frame, the inside ends being joined up as shown. The other four ends are put direct to the terminals, A and B to the left, C to the middle, and D to the right-hand terminal, so that the thin wire or greater resistance is between the two extremes and the thick between the middle and the left-hand terminals. The resistance of the thick wire should be about .4 ohm and the thin 160 ohms; then the ratio will be as 1 : 400. The manner in which the coils are made up will be seen from the figure, and it will also be noticed that the bridge in this case forms a base for the coil cheeks to rest against, thus preventing any slip, "along with its consequences," if subjected to rough usage. By means of the double winding of the coils the instrument can be used either as an ammeter or voltmeter, and by careful calibration and with the constant thus arrived at along with the resistance recorded inside the case for reference, the utility of the instrument is increased far beyond what its name implies.

* * *

THE cable steamer Faraday has finished laying a cable between the Azore Islands and Ireland for the Commercial Cable Company. This completes the fourth cable of that company between the United States and England.

PRINCIPLES OF DYNAMO CONSTRUCTION.—V.

(Written for ELECTRICITY.)

Power to Use in Shunt.

The field winding of dynamos is best designed by starting with a certain basis for losses in the field.

Prof. Jackson has compiled the following table for this purpose:

TABLE OF C^2 R LOSS IN FIELD WINDINGS OF SHUNT AND SERIES DYNAMOS.

R being taken as cold resistance at about 25° C. (75° F.)
Per cent. of full load according to the average American practice.

Capacity of Dynamo.	Loss in Per Cent.
5 kilowatts.	4.5
10 "	3.6
15 "	3.1
20 "	2.8
25 "	2.5
30 "	2.3
35 "	2.1
40 "	1.9
50 "	1.7
60 "	1.5
75 "	1.3
100 "	1.1

R, and therefore the loss, increases one per cent. of its value for each 2½° C. rise in temperature.

As the rise in temperature usually amounts to about 70° to 100° F. for every .3 to .4 watt per square inch, it will assume a higher value at the core itself, or about one-half of a watt per square inch of core surface.

It will be practicable therefore to make the length of core such, that one-half a watt will be radiated for each square inch, thus determining by this means the size of the core with respect to the energy dissipated in heat.

The remarkable discrepancy observable between the constants of Thompson or Forbes and Esson, is due to the fact that Esson takes into account the radiating properties of the adjacent metallic parts. In Forbes' experiment the wire was probably wound upon a body having less radiating surface than a coil on a dynamo, which naturally caused the heat to be almost entirely spent in raising the temperature of the wire to 225° F.

Esson depends upon the conducting power of the core and pole-pieces to partially radiate the heat that aggregates, due to C^2 R losses in the field. With this point in view the constant would more nearly approach the value as given by him. But it is a well-known fact that some makers of electrical machinery wind upon the core direct with the proper insulation underneath, while others, who slip their coils on, use a sleeve which necessitates a bed of air between the core and winding of a variable thickness.

Again, it is a known practice for makers to drill the flanges of magnet coils to accelerate radiation, and others to employ brass instead of rubber or fiber flanges. The custom of using ribbed flanges has developed, and in several large factories dynamo electric machinery is built with them.

INCREASE OF RESISTANCE OF COIL.

The system of assuming a certain rise in temperature and then constructing a formula based upon that fact will enable us to arrive at a certain current giving rise to that temperature and thus indirectly determining the size of the wire to be used.

In the formula already given

C = current.
S = sq. inches of surface. $C = .63\sqrt{\frac{S}{R}}$
R = resistance.

the limiting temperature is 90° F., but the resistance R must be taken at the working temperature of the coil; the increased heat naturally causing a corresponding increase in the resistance of the coils. As a means of considering this increase in resistance, the following rule holds true. The resistance of copper increases as the temperature rises .21 of one per cent. for each degree Fahrenheit, and .38 of one per cent. per degree Centigrade, or,

increase Fahr. = .0021 of an ohm per degree,
Cent. = .0038 " " "

A coil of 10 ohms resistance cold would increase in resistance of its temperature be raised 50° F. as follows:

$$50 \times .0021 = .105$$
$$\text{and } .105 \times 10 = 1.05 \text{ ohms,}$$

therefore the resistance of the coil with an increased temperature of 50° F. would be 11.05 ohms.

A rise of 90° F. is the basis of the above formula; this is rather a large increase if the machine be operating in summer weather with the temperature of 90° F. This growth of heat would mean a total temperature of 180° F., which is too great for ordinary practice. Another writer, however, gives a similar formula based upon a lower temperature of 75° F. and an allowance of two square inches per watt for radiation; we then have

$2\,C^2\,R = S$, or surface in square inches.

$$C^2 = .5\,\frac{S}{R}$$
$$C = .7\,\sqrt{\frac{S}{R}}$$

Windings must never be too deep, because with ordinary current densities in the coil the inner layers will become greatly heated; the object of all these ways and means being solely to preserve as nearly as possible a uniform temperature throughout the coil within certain limits; and this can only be effected by having the current density in the wire, the depth of winding and the radiating surface designed to meet the exigencies of the case.

In the specifications for dynamos it is the practice to call for a limited rise of temperature of not more than 100° F. above the surrounding air.

At a current density of 800 to 1,000 amperes per square inch, the heat will not increase 50° F. above the atmosphere.

With short, stumpy magnets the heat is likely to be greater because of the greater depth of winding, the rough rule already given of one-half watt per square inch at the core and one watt for every two square inches at the outer surface, from one standpoint determines the depth of winding.

We are then confronted with the difficulty, perhaps, of lack of space for the requisite turns. In this case an elongated core would be necessary, or the specific induction, and therefore the ampere turns, decreased. This again would necessitate a greater cross-section of core if a stated number of lines of force be desired, which would also give an increased surface for radiation. This method, if not carried out to excess, constitutes a very useful means of keeping the heat within the limits of practice.

BEST DEPTH OF WINDING.

At the different areas per watt thus given as the best surfaces for radiation a series of diagrams may be constructed showing the relative depths of winding with such conditions imposed.

If a definite area at the core be arrived at as the best to prevent overheating of the inner layers, the calculation of the outer surface of the coil gives at once the depth to which the coil must be wound for a definite temperature rise,

at 1½ sq. inches per watt at the core
and 2½ " " at the
outer surface, the depth of winding will then bear a certain fixed ratio to the diameter of the core, if such a rule be adhered to.

By a simple formula

$$C : C' = D : D'$$

when the circumference and diameter of two coils are compared. But if a core be considered with respect to the outer surface of radiation as the above, both core and winding being of the same length, the ratio of their outer areas is the ratio of their respective diameters. Therefore as $1\frac{1}{2} : 2\frac{1}{2} = 3 : 5$, the diameter of the core to the outer surface of the coil bears the ratio of 3 : 5. A table can be constructed giving these quantities in a tabulated form, as follows:

PER WATT.

F° at Core.	Core surface.	Ratio of depth of winding to core diameter.	Outer coil surface.	F° at surface.	Ratio of core surface to coil surface.
degs.	sq. in.		sq. in.	degs.	
90	2.5	⅕	3.5	64	5 : 7
112.5	2.0	¼	3	75	2 : 2
150	1.5	⅓	2.5	90	3 : 5
225	1.0	½	2.0	112	1 : 2
450	.5	$\frac{3}{3}$	2.0	112	1 : 4

These figures may appear high for practice, but if the insulation between core and winding be somewhat thick, acting as a non conductor to heat, and fiber or rubber flanges be used, then the accumulated heat will only escape from the outer surface at the above temperatures.

The temperature of the core may rise to even a higher point than that given in the table because of the rate of emission being less. The proper area must therefore be allowed or a dangerous rise will be inevitable. The more nearly the core diameter approaches the coil diameter, the less becomes the heating at the core and the more it tends to become uniform throughout the coil.

If the rule adopted be that three square inches of coil surface be allowed per watt of heat and two square inches at the core for the same purpose, then the depth of winding becomes by such a proportion one-quarter of the diameter of the core and the rise in temperature 75° F.

With the 3 : 5 ratio and 90° rise the depth of winding would be one-third of the diameter of the core, and with the 1 : 2 ratio and 112° rise the depth of coil is one-half of the core diameter. It is common practice to use the 3 : 5 ratio, though the fact was neglected that a proportion between the surface and heat energy must be observed. This disregard led to the construction of coils magnetically correct but exceedingly wasteful and inefficient.

CHARRING OF COILS.

It was deemed at one time sufficient to wind to a certain depth (a percentage of the core diameter), to obtain a certain magnetic output, and allow the heat question to take care of itself.

Wire insulation becomes gradually charred if persistently exposed to a moderately high temperature, which ultimately causes the ruination of the coil. It is therefore highly advisable to design the magnet coils so as to have copper sufficient for the distribution of the heat, otherwise the introduction of a machine with scanty field winding to the hot engine room may mean a great increase in the resistance of the coils, therefore a weaker field and lower voltage; so that, even though the immediate question be ignored, other disastrous results follow from a neglect of it.

MAGNETIC INSTABILITY.

It must be understood that in cases where the specific induction is low, the winding is less, and the depth of winding very much below the average; this would mean an increased surface for fewer watts and therefore less heating. Special cases arise in which, due to the limited coil space, a lower induction must be adopted. There is a great likelihood of magnetic unstability resulting from this practice; by an examination of the magnetization curve it may be seen that below 15,000 per sq. cm. such a likelihood exists, as fluctuations or drop in EMF of the armature may by merely a few volts difference cause a great change in the ampere turns and therefore in the resulting field.

The gradual recognition of the fact that increased coil surface reduced the copper which would otherwise be required, incited many manufacturers to increase the cross-section of the cores while keeping the specific induction constant; it being well-known that ampere turns are only considered per unit length with respect to the induction per unit area. The increased length of the ampere turn, the actual number being the same, supplies the magnetizing force for the additional iron area, but at the same time gives more radiating surface for the emission of heat.

S. P. Thompson gives a formula:

Ampere turns = constant × by length of wire × square root of depth of winding, or

$$X = a\,l\,\sqrt{D}$$

in which X = ampere turns,
l = length wire in inches,
D = depth of winding in inches,
a = constant having the values according to the diameter of the wire, as follows:

diam. in mils.	a
40	522
120	542
200	570

that constant being dependent upon the size and insulation of the wire.

* * *

EXTENSIVE additions will be made to the electric plant of the Puget Sound Navy Yard in the near future, including the installation of boilers, engines, dynamos and other machinery. Already the Government has issued calls for bids for furnishing the necessary machinery and mechanical equipments for these improvements, and copies of this call for bids received in Seattle, Wash., require that the materials must be delivered at the yards within 30 and 60 days after the acceptance of the contract.

FINAL REPORT OF COMMITTEE ON STANDARDIZATION OF ENGINES AND DYNAMOS.*

The Committee on Standardization of Engines and Dynamos has now completed its labors and has the pleasure to submit its final report, which it hopes will prove satisfactory to the Society.

Since our last report at Milwaukee, the Committee has continued its work on the same lines as hitherto, taking up carefully with manufacturers of engines and generators the points remaining to be standardized. We are glad to be able to repeat what we have said in previous reports, that the comments which have been received are almost without exception commendatory and show not only a willingness to adopt the Committee's recommendations, but an appreciation of the work which has deen done.

The Committee's investigation has covered the standardization of the following points:

(1) The standard sizes of units recommended.

(2) The corresponding revolutions per minute for these units.

(3) The sizes of shafts for the two classes of center-crank and side-crank engines.

(4) The length along the shaft required for the generator.

(5) The height of axis for shaft over top of sub-base.

(6) The width of top of sub base.

(7) Armature fit.

(8) Overload capacity of engines and generators.

(9) Brush-holders

(10) Holding-down bolts, keys, and outboard bearings.

SIZE OF UNITS.

Our endeavor has been to reduce the number of standard units to the fewest sizes. This will commend itself to all manufacturers as tending to reduce the great number of patterns required to be kept on hand. For reasons stated in our report to the Milwaukee meeting, the largest size embraced in our list is 200 kw. capacity.

In this connection our report only covers the standardization of direct-current generators.

REVOLUTIONS.

These standard speeds have been chosen after careful deliberation and investigation of the practice of all the engine and generator builders in the country. It will be observed that we have provided for a permissible variation of speed of 5 per cent. above or below the mean speed, which we recommend; an examination of the practice of all the engine and generator builders shows that this covers practically all the machines that may be considered as a standard make at the present time, and we have been assured by some builders whose conditions differ somewhat that if there is a general agreement upon the scheme outlined, they will be prepared to change their machinery to conform to the recommendations.

SHAFT DIAMETERS.

These are also the results of careful analysis of the existing practice of all manufacturers and a consideration of all the conditions affecting the diameter of the shaft. The preliminary report which we sent out to the manufacturers has elicited only a few adverse criticisms, and these, after correspondence, were withdrawn.

In order that the reason for the diameters of shafts that we have recommended shall be thoroughly understood. we may explain that (especially in shafts for side-crank engines) the permissible deflection has determined the diameter. This, in some cases, is larger than would have been necessary for torsion and bending where deflection did not have to be considered.

As cases sometimes arise where cross compound engines or double engines are connected to generators coming within our recommendation, and as such units require considerably larger shafts than those given in our tables, we deem it necessary to state, specifically, that our recommendations apply only to engines of usual proportions, with the generator attached at the side of, instead of between, the cranks.

LENGTH OF GENERATOR ALONG THE SHAFT.

When we came to investigate the question of length along the shaft (between limit lines) to be provided for the generators, we found that the practice of manufacturers required provision for two classes, which may be called "long" and "short" generators.

It would, of course, have been much better if we could have provided for but a single class, with a small allowance for variation, but there is such a marked difference in the lengths for the same power that we have deemed it best to make provision for these two classes, so that the engine builders can govern themselves accordingly. It will be noticed that the maximum difference in lengths between the two classes is six inches, which in the small sizes is reduced to five inches.

In the case where an engine is to be provided for a generator which falls into the "long" class, but which is only a little over the limit for the "short" class, or one which is considerably less than the maximum of the "short" class, the excess clearance is to be provided for on the side next to the engine; that is to say, the side away from the commutator.

We have carefully considered the fact that for these varying lengths of generator and shaft the engine builder has to provide different lengths of sub-base, and in order to reduce the expense of patterns here to a minimum, our idea is that these patterns would be made so that the end away from the commutator can be extended the necessary amount, five or six inches, to take care of the increased length of bed. Obviously, this means simply a standard pattern with a standard adjustable end for each unit.

HEIGHT OF SHAFT.

As is well known, there are two classes of generators to be provided for under this head: Those which are split vertically, and those which are split horizontally. The former have a flat base which rests directly upon the flat top of the sub-base, while the latter have feet which take the weight of the generator.

In order to arrange that the engine builders' patterns may be reduced to a minimum and still may be stock patterns, which will fit every style of machine, we have chosen dimensions for height of axis of shaft above top of sub-base, sufficient to allow for the vertically-split machines, and also, except as stated later, to clear the periphery of the horizontally-split machines.

As will be seen, the scheme provides for a main pattern to which patterns for the stools and seatings for both horizontally and vertically-split generators can be attached before the pattern is sent to the foundry—stools for the horizontally-split machines and rectangular seatings for the vertically split machines.

In the case of the 150 and 200 kilowatt units, we have provided for a recess in the top of sub-base to allow the lower part of some horizontally-split generator frames to be accommodated, and so to avoid unduly raising the center of the shaft. In the case of the vertically split machines and those which are split horizontally and do not need this recess, the top of the sub-base will be flat and continuous.

WIDTH OF TOP OF SUB BASE.

This has been decided by careful examination of existing practice, and we believe that the figures that we have recommended will cover the necessities for all sizes of generators.

ARMATURE FIT.

The matter of armature fit has received very careful consideration from the Committee and our recommendation is for what is known as a single fit.

We have obtained the opinions of manufacturers in respect to the allowance to be made for a pressed fit, and find that allowance of 1-1,000th inch for shafts 4 inches to 6 inches, inclusive, and 2-1,000th inch for shafts 6½ inches to 11 inches, inclusive, represent the best existing practice.

The armature bore is to be the exact size given in the table, and the allowance is to be made by the increase of diameter of engine shaft.

We believe, that in order to secure the best results, it will be necessary to work to a definite gauge; to this end we recommend that the generator builder furnish a gauge the exact diameter of the bore and the engine builder make the necesary allowance for the pressed fit, as recommended. This will avoid uncertainty as to the responsibility for the fit.

OVERLOAD CAPACITY OF ENGINES AND GENERATORS.

All the features of our recommendation have so far had to do with the question of dimensions as affected by the mutual relations of the generator and the engine. An important point, however, which affects both the generator and the engine, is that of the overload capacity which can reasonably be expected. As is doubtless well known, generator builders are frequently called upon to provide, during short periods, for overloads of as much as 50 per cent., and, in occasional cases, of even 100 per cent.

It is evident to every engine builder that to provide an engine large enough to drive the generator under such extreme overload capacities, gives an unreasonably large engine for the rated load, and seriously interferes with the economy with which the power is produced.

Bearing in mind that our recommendations are entirely for standard practice, we are led to recommend that the standard overload rating of any direct-connected unit should not, in any case, exceed 25 per cent. of the rated capacity.

It will, of course, be understood that under these conditions of overload the economy of the unit should not be expected to be as high as when operated at the rated load. We have also been asked by some engine builders to call attention to the importance of giving the unit special attention when it is so operated.

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*Paper read at the meeting of the American Society of Mechanical Engineers, held in New York, Dec. 3-6, 1901.

If, under peculiar conditions, a higher overload capacity is demanded, it must be understood that this is a special case not covered by the standard machines, and provision must accordingly be made for meeting this demand.

BRUSH HOLDERS.

We recommend what we believe is now the practice of the best generator builders, that the brush-holder rigging shall be supported upon the generator frame. This, we think, will commend itself, as it makes the electrical part of the outfit entirely self-contained.

HOLDING-DOWN BOLTS, KEYS, AND OUTBOARD BEARINGS.

We recommend that the holding-down bolts, shaft keys for securing the generator hub to the shaft, and the outboard bearings should be furnished by the engine builders. This is in accord with almost universal practice at the present time.

Our recommendations in these particulars do not cover matters of so great importance as some others; but, if adopted, they will tend to settle certain points about which there has occasionally been dispute and considerable controversy in correspondence.

In the table will be found columns showing sizes of shaft keys which we recommend; also the number and size of holding-down bolts.

It will be noticed that we do not give any lengths for keys. We gave this matter very careful consideration, but we found that such differences of opinion existed in respect to proper length, that we believe it best to leave the determination of the length of key for adjustment by engine and generator builders in each individual case.

Sizes of keys have been taken so that standard rolled stock can be employed.

We recommend that the keys be made straight and be used as feathers. They should therefore fit accurately on the edges and not on the top. Proper allowance should be made in cutting the keyway in the armature hub, so that there will be sufficient clearance at the top of the key.

SUGGESTIONS.

In the course of our investigation our attention has been called to a number of points, which, from their nature, are not exactly in the same category as those on which we have made recommendations, but we consider them of such importance that we desire to offer them as suggestions for consideration by members of the Society, with a view to their adoption if considered sufficiently meritorious.

A. Pressing Armature on Shaft.—Usually the contract definitely provides by whom this is to be done, but our suggestion is that if there is no such provision in the contract, it should be understood that the engine and generator builders shall agree who is to do this work, so as to avoid any dispute when the separate portions of the unit are delivered on the premises.

B. Floor Line.—For convenience in operation and for the information of engine and generator builders, we suggest that for units up to 75 kilowatts, inclusive, the floor line should come at the bottom of the sub-base; and for units 100 kilowatts to 200 kilowatts, inclusive, the floor line should be one inch below the rough top of the sub-base.

C. Protecting Commutators from Oil.—In view of the fact that in some cases the distance between bearing and commutator is very small, it is well for engine builders to bear in mind that provision should be made to prevent oil from the bearing getting on the commutator.

D. Some generator builders have asked that the end of the shaft be drilled and tapped

TABLE OF SIZES, SPEEDS, AND STANDARDIZED DIMENSIONS OF DIRECT-CONNECTED GENERATING SETS.

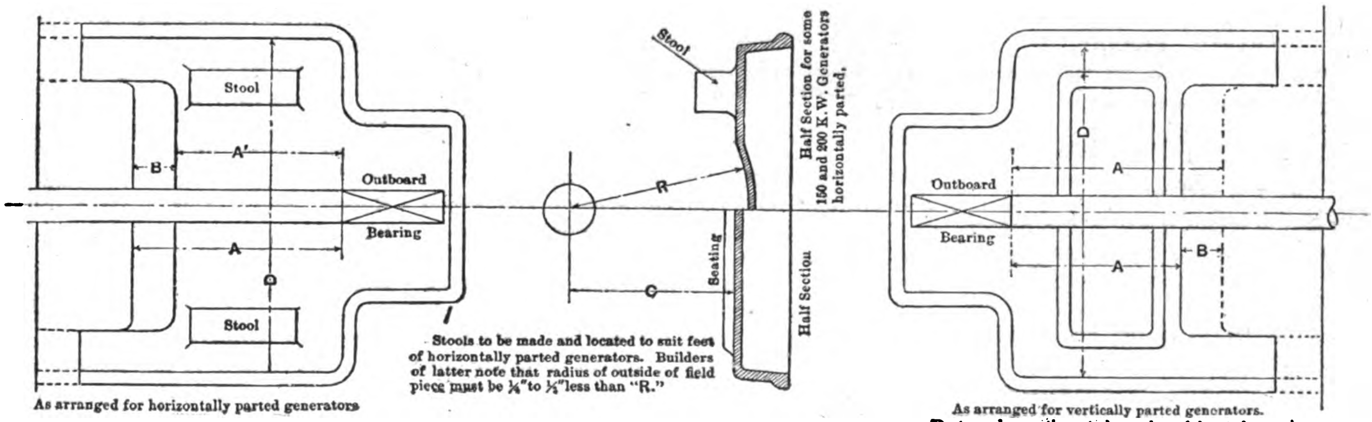
(To accompany Diagram.)

Capacity of Unit, Kilowatts.	Revolutions per Minute.	ARMATURE BORE.		DIAMETER OF ENGINE SHAFT AT ARMATURE FIT.		SPACE OCCUPIED ON SHAFT BETWEEN THE LIMIT LINES.		*B*, Length of Extension Pieces, Inches.	*C*, Height of Axis of Shaft above Top of Base, Inches.	*R*, Inches.	*D*, Width of Top of Sub-Base, Inches.	KEY (A FEATHER).				HOLDING-DOWN BOLTS.	
		Centre Crank Engines, Inches.	Side Crank Engines, Inches.	Centre Crank Engines, Inches.	Side Crank Engines, Inches.	Long Class *A*, Inches.	Short Class *A′*, Inches.					Width, Inches.	Thickness, Inches.	Depth in Shaft at Edge, Inches.	Projection above Shaft at Edge, Inches.	Diameter, Inches.	Number.
25	310	4	4½	4 + $\frac{1}{1000}$	4½ + $\frac{1}{1000}$	30	25	5	23½	Flat.	48	1	¾	⅜	⅜	1	4
35	300	4	5½	4 + $\frac{1}{1000}$	5½ + $\frac{1}{1000}$	33	28	5	25	Flat.	54	1	¾	⅜	⅜	1	4
50	290	4½	6½	4½ + $\frac{1}{1000}$	6½ + $\frac{2}{1000}$	37	31	6	28	Flat.	60	1¼	¾	⅜	⅜	1	4
75	275	5½	7½	5½ + $\frac{1}{1000}$	7½ + $\frac{2}{1000}$	43	37	6	31	Flat.	66	1½	1	½	½	1½	4
100	260	6	8½	6 + $\frac{1}{1000}$	8½ + $\frac{2}{1000}$	48	42	6	34	Flat.	72	1½	1	½	½	1½	4
150	225	7	10	7 + $\frac{2}{1000}$	10 + $\frac{2}{1000}$	51	45	6	37½	41½	84	1¾	1¼	⅝	⅝	1½	4
200	200	8	11	8 + $\frac{2}{1000}$	11 + $\frac{2}{1000}$	54	48	6	42½	47½	96	2	1¼	⅝	⅝	1½	4

NOTE 1.—Five per cent. variation of speed permissible above and below speeds in table.

NOTE 2.—Distance from centre of shaft to top of base of outboard bearing may be less than *C* (to suit engine builder), though not less than possible outside radius of armature.

DIAGRAM.



As arranged for horizontally parted generators

Stools to be made and located to suit feet of horizontally parted generators. Builders of latter note that radius of outside of field piece must be ¼" to ½" less than "R."

As arranged for vertically parted generators.
Rectangular seatings to be made and located to suit bases of vertically parted generators.

facilitate, if necessary, the removal or placing of the armature on the shaft at the place of erection; we suggest that this be done.

E. In some cases, generator builders require special nuts, bolts, or fixtures for attaching generators to the shaft. Under these conditions we suggest that the generator builders should furnish all attachments to their apparatus that are not already specified in our report.

IN CONCLUSION.

In concluding our labors, we desire to express our appreciation of the great interest in our work which has been shown by the engine and generator builders. They have realized that it was for their benefit, and they have helped us very materially by supplying freely the data in their posession and by their intelligent comments and criticisms of our various recommendations. We may say, indeed, that it is this spirit of helpfulness and appreciation that has encouraged us to devote the great amount of time and labor which we have given to the solution of the problem.

We wish also to express our indebtedness to Prof. John E. Sweet, who, as president of the Engine Builders' Association and chairman of their committee on standardization, has attended all of our meetings and given us the benefit of his counsel and ripe experience.

We believe that the recommendations we submit herewith will accomplish the object for which the committee was appointed, and will, if adopted generally by manufacturers, which we have every reason to anticipate, reduce the cost of manufacture, expedite deliveries, and remove many causes of complication and dissatisfaction.

The favorable reception accorded to our preliminary report by the Society leads us to hope that our completed work will be equally satisfactory.

James B. Stanwood,
Frank H. Ball,
Wm. D. Fobbes,
Walter M. McFarland,
Albert L. Rohrer,
Committee on Standardization of Engines and Dynamos.

A SILENT CHAIN GEAR.*

BY J. O. NIXON.

The advantages of chain gearing for power transmission have long been recognized by the engineer, and since the introduction of the Ewart Detachable Link-Belt in the early seventies, the use of drive chains has steadily increased, until now many million feet of driving chain are made and sold every year.

While the field in which this immense quantity of chain is used is necessarily very large, it is only a small part of the whole realm of power transmission. The reasons why chain gearing has been thus limited in its application are:

First.—The noise heretofore inseparable from all chain gearing.

Second.—The comparatively low speed limits.

Third.—The more or less rapid increase of noise and jar due to the stretch and wear of the chain and the wear of the wheel.

These three defects, inherent in all ordinary chains, are due to the stretch of the chain, by its elasticity and by wear, both internal and external, which make a chain, as soon as it is started up, too large for the sprocket which it was made to fit.

Fig. 1 will possibly make this clearer. The figure shows a driven sprocket wheel and a chain of the ordinary type. This chain, it is assumed, was made to fit the sprockets. However, as soon as the gear was started up, the pitch lengthened so that this is no longer the case. This lengthening of the pitch, or stretch, is due to the following causes: The pins bed in their bearings, the stress on the chain stretches the metal, which is, of course, elastic, and wear of the pins and of their bearings begins at once and is a constantly increasing factor. Add to this the decrease in root diameter of the sprocket due to wear, and we have the conditions shown in the figure, of a wheel running with a chain which is too big for it. This means that one tooth alone is doing all the work at any given time.

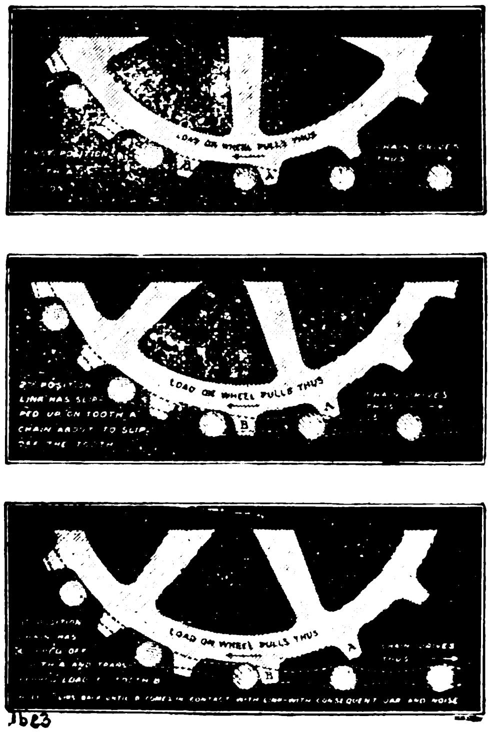


FIG. 1.—ORDINARY CHAIN AND SPROCKET.

In the first section of Fig. 1 we have tooth *A* in action; in the second section the wheel has revolved and the chain is about to slip off tooth *A*, and in the third section the chain has slipped off, and the wheel has slipped back under the influence of the load, until tooth *B* comes in contact with the chain. This slipping back of the wheel makes a noise and causes a shock to both chain and wheel. These shocks occur every time a link passes out of mesh and, therefore, at even very moderate speeds, the number per minute is very large. It has been proved by experiment and by practice that this jarring action is very wasteful of power, and that the amount of power consumed by it increases more rapidly than the speed increases, so that the allowable useful working stress becomes smaller and smaller with increasing speed. This limits the speed at which a chain may be run. Of course this limiting speed varies greatly for various styles of chain and is much higher for a steel roller chain of proper design than for a malleable chain. What has been said above with reference to a driven sprocket applies with equal force to the driver.

From the foregoing it will be immediately inferred that the solution of the problem of producing a high speed and a silent chain gear lies in the production of a wheel and chain which shall always remain a perfect fit each with the other entirely independent of the stretch of the chain. Such a chain gear has been developed by Mr. Hans Renold, of Manchester, England, and has been in wide and successful use in Europe for some five years past. This chain gear consists of a chain composed of links of a peculiar form stamped from the sheet or cut from a drawn bar fastened together by shouldered rivets into a chain of any desired width (Figs. 2, 3 and 4) running over cut sprocket wheels with teeth of a shape varying with the size of the wheel. It is absolutely silent and may be run at high speeds. It is capable of transmitting any amount of power from the smallest to the greatest.

How the Renold chain gear accomplishes its results may be best seen by reference to Fig. 5. It will be noted at once that the chain has contact with the wheel on the faces of the teeth only, and not on the root circle at any time. The flat bearing surfaces of chain and wheel at corresponding angles cause the chain to take the form of a perfect circle at all times, with a pitch diameter corresponding to the pitch of the chain, and not to the pitch of the wheel, as is the case where the bearing is on the root circle. Because of the above, every tooth in mesh is in equal contact with the chain, and remains so whatever the stretch. As any given tooth goes out of contact with the chain there is no slipping back of the chain, for the next, and every other tooth in mesh, is in perfect working contact with it. Thus there is no noise connected with the operation of the chain, and the cause which limits the speed of the ordinary chain gear does not exist. The first section of Fig. 5 shows a new chain on the sprocket; the second section shows the same chain after having stretched, and illustrates how the chain automatically adjusts itself to the sprocket, remaining always a perfect fit for it; the third section shows the rolling action of the chain as it comes into mesh. There is seen to be no sliding of the chain on the sprocket tooth, which means, of course, minimum of wear and a maximum of efficiency. The Renold Silent Chain Gear, as Mr. Renold has named this development, is therefore noiseless; it can be run at high speeds; and it retains the originally perfect action until worn out. Another valuable property, which is a corollary of the self-adjusting feature of the chain, is the possibility of running two or more chains side by side on the same wheels. In this way, when large powers are to be transmitted, and the width of chain necessary becomes too great for convenience in manufacture or in handling, several chains may be used with the perfect assurance that each will bear its proper share of the load. This is in great contrast to the known impossibility of getting two ordinary chains to stretch evenly and so distribute the load between them. As the number of chains becomes greater the difficulty by the old method is more than proportionately increased.

The life of a chain is the length of time which it will take to stretch it so much that it ceases to have any bearing whatever on the teeth of the sprocket wheels. A very small bearing will suffice, because the load is divided between all the teeth in mesh. Hence, to prolong the life of the chain, the steel used in its manufacture must be of the very highest grade obtainable, and it must be worked with the utmost accuracy. A steel for the links of high tensile strength allows the use of pins or rivets of large diameter while preserving the tensile strength of the chain as a whole. The large bearing surface so obtained is rendered yet more valuable by the use of hardened pins of high grade material. The washers on the ends of the rivets claim no little attention. They must be small in diameter and not too thick. This necessitates a steel of high tensile strength and elasticity, so that the washer shall grip the rivet end when it is forced over it and still, by its small size, not add to the bulk nor detract from the appearance of the chain.

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*Paper read at the meeting of the American Society of Mechanical Engineers held in New York Dec. 3-6, 1901.

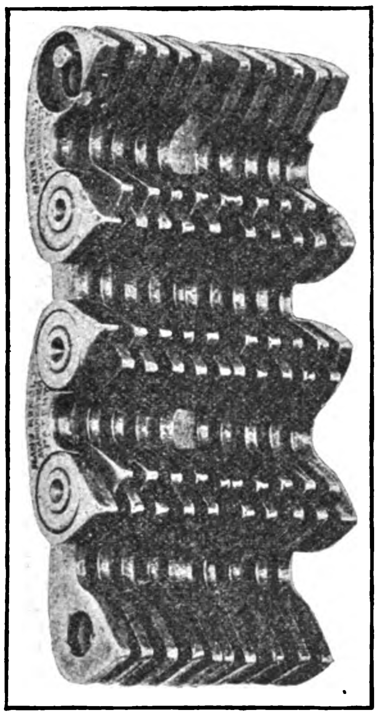

Fig. 2.
Stamped Chain.

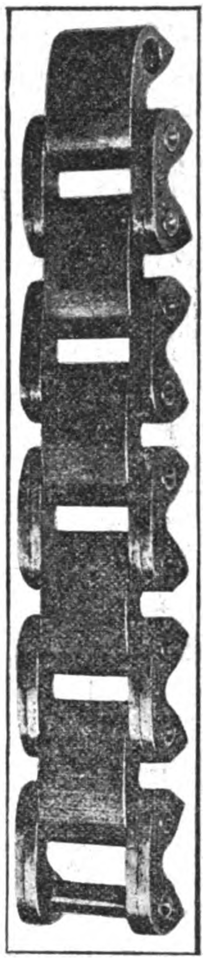

Fig. 3.
Block Chain.

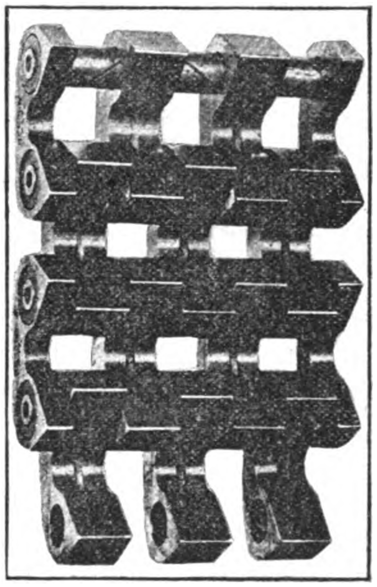

Fig. 4.
Multiple Block Chain.

From the question of material one naturally passes to the allowable limits of error in workmanship. In a general way it may be said that the chain should be as accurate as it is possible to make it. The pitch must be accurate, the holes must be properly located, and the rivets must be neither so short as to bind the links nor so long as to give excessive play.

The sprockets used with the silent chain form, of course, an indispensable part of the gear. They must be accurately cut with special cutters and may be of any material. The teeth have straight sides to give a full bearing with the working surfaces of the chain. The angle of the tooth is different for every diameter of sprocket; or, to put it in another way, the angle between the sides of the tooth becomes greater as the number of teeth increases. The limits to the number of teeth that may be employed are practically fixed at 18 and 120. The former limit is set by the fact that in a wheel with this number of teeth, the sides of the teeth are parallel. Conversely when a wheel has 120 teeth, the tooth becomes so blunted as to make slipping a possibility, so that this number should be exceeded only where the load is absolutely uniform.

This variation of the tooth shape is illustrated in Fig. 6, which shows several steps in this gradual change of shape. It will be readily understood that the variation between the shapes shown is a gradual and not a sudden transition. The fact that the load on the sprocket teeth is distributed over all the teeth in mesh obviates the necessity of using a metal of high tensile strength for the sprocket wheels. The fact that there is no sliding of the chain on the sprocket teeth obviates the necessity of using a very hard metal to mimimize wear. It is therefore possible to make a strong and durable sprocket wheel of cast-iron. Steel, however, has been used for the small wheel on automobiles, and in other cases where the service was particularly severe. The flanges are put on after the teeth are cut, and are either shrunk on, or riveted to the wheel.

With regard to the practical use of the chain the following points may prove of interest: It is obviously necessary that one wheel of the pair be flanged to prevent the chain running off; it has been found that better action is obtained where the driven wheel is flanged; the chains may be run with the sprockets so close together as to barely clear, or the drive may be of any length up to ten to fifteen feet without supporting idlers and, if such support be used, may be of any length found economical and desirable.

The only factor so far found which serves to limit the speed is the difficulty of keeping the lubricant on the chain at very high speeds. At speeds exceeding 1,350 to 1,400 feet per minute, the oil is thrown off by centrifugal force, but speeds as high as 2,300 feet have been employed successfully by inclosing chain and wheels and running them in oil. The particular case in mind was the transmission of 75 hp. from the motors to the car axle on the Mono-rail Railway, at the Brussels Exposition. This is the type of road which is soon to be erected between Liverpool and Manchester.

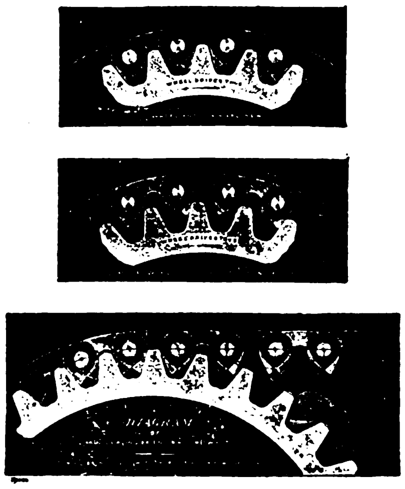

Fig. 5.—Silent Chain and Sprocket.

This is by no means the only case where high speeds have been attained by inclosing the gear, but is simply cited as typical. In this connection, however, it may be well to call attention to the fact that the chain speeds being lower than the speeds necessary for belting, allows sprockets of correspondingly smaller diameters for the same angular velocities. The chain thus effects a marked economy of space, not only in the diameter of the wheels, but because of the comparatively long centers absolutely essential with belting. The line of centers may be horizontal, inclined, or vertical, provided that the shafts are parallel, but there are two limitations on vertical drives. The small wheel shall not be the upper one, because the weight of the chain crowds it into the sprocket and gives bad action. Some form of tightening device should be provided either by adjusting the centers, or by an idle roller on the slack side of the chain, so as to prevent the chain, when it stretches, from falling away from the lower sprocket. Both of these troubles may be obviated by inclining the line of centers.

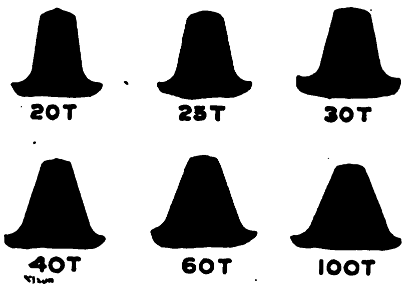

Fig. 6.—Shapes of Wheel Teeth.

Wherever the chain gear is exposed to dust or grit of any sort, it should be inclosed in a dust-tight casing. In any case, a light metal guard should be provided to prevent anything falling into the gear.

The statement was made in the beginning of this paper that the causes which had heretofore limited the use of chain of gearing were the speed limit, the noise, and the more or less rapid deterioration of the action of chain and wheels. We have now seen how these three defects have been eliminated in the Renold Silent Chain Gear, and this question naturally arises: "To what is the silent chain gear especially applicable, and how has it proved its usefulness in the past?" An answer to the latter half of this question will also be the best answer to the first half.

It is hard to name a branch of the mechanical world in which the silent chain has not made a permanent and honored place for itself. It has been used on machine tools in numberless ways; it forms an integral part of many special machines; it drives shallow-draught gunboats on the Nile, and heavy gun lathes in Sheffield. Engine governors are driven by it, and the motors whose power is transmitted through this medium are hundreds in number and of all sizes, from the smallest to the largest. Builders of automobiles of all types have found that the silent chain offers the solution of their difficulties and it is in use to day on hundreds of cars, from the light three-wheeled pleasure carriage to the heavy steam truck. In our own country Messrs. Brown & Sharpe have been using this chain for some time for driving the spindles and feeds on their machines. The new factory of the Natural Food Company, at Niagara Falls, is driven throughout by silent chain. Here the service is severe because of the sudden start and quick acceleration, under load, of the induction motors used. The drives vary in size from 1 to 40 hp. These are only notable instances, for already the chain is in use in many varieties of service on this side of the water.

To sum up:

The Renold Silent Chain Gear possesses, in common with all chain gears, these advantages.

(1) A positive speed ratio (no slip).

(2) No tension in the slack side of the chain and, therefore, a minimized loss in journal friction.

(3) Adaptability to short centers or to long centers.

(4) Adaptability to hot or damp situations.

In addition to these it possesses the following unique advantages:

(1) It is silent.

(2) It may be run at high speeds.

(3) The initially perfect action is preserved throughout the life of the chain.

(4) The load is distributed over all the teeth in mesh.

It is superior to leather or rubber belts because—

(1) It provides a positive speed ratio.

(2) There is a minimum loss in journal friction.

(3) It can be used in hot or damp situations.

(4) It can be used on short centers without a troublesome and wasteful idler.

It is superior to spur gearing because—

(1) It is noiseless.

(2) It does not require fixed centers.

(3) It does not require short centers.

(4) There is no sliding friction on the teeth, hence it is more efficient.

(5) It is smoother in action and generally more durable.

The writer believes that no one who has given the subject even casual thought will dispute the assertion that the development of the Renold Silent Chain Gear marks an era in the history of power transmission.

PERSONAL MENTION.

Prof. Sidney H. Short sailed for England last week. He was accompanied by Mrs. Short and will be absent for several months.

Dr. F. A. C. Perrine has returned to Pittsfield, Mass., after a long absence on the Pacific Coast.

Prof. Richard O. Heinrich, general manager of the European Weston Electrical Instrument Company, of Berlin, sailed for Europe last week after an enjoyable visit in New York and other cities.

Mr. . W. Pentecost has been appointed superintendent of the Nashville, Tenn., electric plant, which is now in course of erection.

INCORPORATIONS.

The Incandescent Light & Stove Company, Cincinnati, O. Capital stock, $300,000.

The Miller Storage Battery & Electric Company, Bellefontaine, O. Capital stock, $20,000.

The H. C. Dodge Electric Company, Chicago, Ill. Capital stock, $10,000. Incorporators: Max I. Heldman, Stanley Kubrenner and William T. L. Rafferty.

The Stratton Motor Company, New York City. Capital stock, $150,000. Directors: E. F. Stratton and David Wood of New York City, and G. H. Murray, Jr., of Hollis, L. I.

The Newfane Electric Company, Newfane, N. Y. Capital stock, $1,000. Directors: C. T. Raymond and J. H. Eilers, of Lockport, and Joseph Robinson of Newfane.

The Wolfe City Electric Light & Power Company, Wolfe City, Tex. Capital stock, $10,000. Incorporators; C. R. Seltzer, W. R. Seltzer and I. Jacobs.

The Prometheus Electric Company, New York City. Capital stock, $500,000. Directors: B. T. Lynch, of Brooklyn, and S G Stewart and George Russell, of New York City.

The Joseph & Elgin Electric Railway Company, Joseph, Ore. Capital stock, $5,000. Incorporators: E D. McCully, C. E. Jennings, Peter Boudon, George Mack, Polk Mays and E. W. Rimble.

The California Gas & Electric Corporation, San Francisco, Cal. Capital stock, $30,000,000. Incorporators John Martin, A. E. Childs, R. R. Colgate, Eugene de Sabla, Jr., R. M. Hotaling, L. P. Lowe, W. M. Pierson, J. C. Coleman and C. A. Grow.

The Carolina Electric Company, Maxton, N. C. Capital stock, $50,000. Incorporators: W. S. McNair, H. C. McNair, Mary S. McNair and Susie M McNair, all of Maxton.

The Wilson Water & Electric Company, Arkadelphia, Ark. Capital stock, $75,000. Officers: J. W. Wilson, president and treasurer; J. H. Crawford, vice-president, and Josiah Hardage, secretary,

The New Jersey Electrical Construction Company, Newark, N. J.—to install and construct electrical plants. Capital stock, $125,000. Incorporators: George W. Cook, Bloomfield, and Howard C. Baldwin and Charles E Baldwin, of Newark.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DEC. 3, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

687,766. Trolley for Electric Railways Employing Overhead Conductors. William F. Mack, South Bethlehem, Pa. Filed Sept. 9, 1901.

687,718. Car-Fender. John Craig, San Francisco, Cal., assignor of one-third to Jeremiah Deasy, same place. Filed Aug. 8, 1901.

687,861. Trolley-Guard. Albert W. Smith, Pineriver, N. H., assignor to Leonard D. Butterfield, Revere, Mass. Filed Jan. 16, 1901.

687,950. Trolley. John Zumbrunnen, Elliott, Pa. Filed April 13, 1901.

688,045. Electric Signal System for Railways. Adoniram J. Wilson, Westfield, N. J., assignor to the Hall Signal Company. Filed May 23, 1900.

688,130. Controller for Electric Cars. Barton W. Scott, San Jose, Cal. Filed April 30, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

687,738. Lantern for Electric or Other Lights. John C. Fleming, Summit, N. J. Filed Dec. 8, 1900.

687,883. Terminal for Electric Vapor or Gas Lamps. Peter C. Hewitt, New York City, assignor to Peter C. Hewitt, trustee, same place. Filed April 18, 1900.

687,948. Electric Lamp. Thomas A. Smith, Azusa, Cal. Filed Jan. 18, 1900.

688,176. Regulating-Socket for Multifilament Incandescent Lamps. Charles A. Hussey, New York City, assignor to William P. Pinckard, Birmingham, Ala. Filed March 16, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

687,723. Electric Motor. David P. Burdon, Jacksonville, Fla. Filed July 26, 1901.

687,729. Oscillating Device for Brush-Holders for Electrical Machines. William Cooper, Cincinnati, Ohio, assignor to the Bullock Electric Manufacturing Company, same place. Filed April 9, 1900.

687,829. Electric Controller. Charles H. Keeney, Milwaukee, Wis. Filed Sept. 14, 1901.

687,916. Electric Switch. Edward S. Cook and William H. Chipperfield, London, Eng. Filed March 22, 1901.

687,991. Dynamo-Frame. Alexander Churchward, Chicago, Ill., assignor to the General Electric Company of New York. Filed June 12, 1899. Renewed June 28, 1901.

687,992. Dynamo-Electric Machinery. Alexander Churchward, Chicago, Ill., assignor to the General Electric Company of New York. Filed Dec. 18, 1899. Renewed Aug. 14, 1901.

688,058. Instrument for Measuring the Resistance of Electric Circuits. Edward K. Brown, Springfield, Mass. Filed April 1, 1901.

688,150. Electric Motor. Joseph Darling, Chicora, Pa. Filed June 5, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

687,996-687,997-687,998-687,999. Telephone-Receiver. Hans Liebreich, Detroit, Mich. Filed Nov. 30, 1900.

688,184. Telephone Attachment. John A. Rice, Bland, N. Mex., assignor of one-half to Charles W. Graves, same place. Filed March 29, 1901.

688,194. Automatic Monitor for Telephone-Exchanges. James B. Lee, Charleston, S. C. Filed Sept. 1, 1900.

MISCELLANEOUS.

687,744. Running-Gear for Motor-Vehicles. Charles R. Greuter, Holyoke, Mass., assignor to the Holyoke Automobile Company, Jersey City, N. J. Filed Feb. 15, 1900.

687,775. Electric Latch for Elevator-Doors. Norton P. Otis, Yonkers, and August Sundt, New York City, assignors to the Otis Elevator Company, East Orange, N. J. Filed Aug. 14, 1900.

687,800. Plant for the Electrodeposition of Metals. Arthur L. Walker, Perth Amboy, N. J. Filed March 28, 1900.

687,812. Capping for Electric Conduits. William F. Bossert, Utica, N. Y., assignor to the Bossert Electric Construction Company, same place. Filed Dec. 28, 1900.

687,816. Signal Operating Apparatus. Clarence W. Coleman, Westfield, N. J., and Llewellyn Thomas, Chicago, Ill., assignors to the Hall Signal Company. Filed Feb. 16, 1901.

687,833. Battery. Paul E. Francken, Brussels, Belgium. Filed July 25, 1900.

687,885. Electric Battery. Georges d'Infreville, New York City. Filed Jan. 3, 1901.

687,908. Electrical Heat-Regulating Apparatus. Heinrich Schultz, Berlin, Germany. Filed July 29, 1898.

687,931. Magnetic Holding Table for Metal-Working Machines. Mark Barr, Broadheath, Eng., assignor to the Linotype Company, Limited, London, Eng. Filed Aug. 6, 1900.

687,932. Electric Conductor and Attachment for Printing Presses. Charles H. Colby, Mt. Pleasant, Ia., assignor of one-half to R. F. Struthers, Des Moines, Ia. Filed April 20, 1901.

687,948. Electric Signaling and Indicating Apparatus. Frank W. Wood, Newport News, Va. Filed May 13, 1901.

687,957. Automobile. Jesse Fortner, New York City. Filed Sept. 6, 1901.

687,982. Implement for Sinking Electrical Ground-Plugs. Wilber E. Fisher, Bloomsburg, Pa. Filed April 22, 1901.

688,024. Steering-Gear and Brake for Automobiles. Frank F. Loomis, Akron, O. Filed May 24, 1900.

688,025. Controller for Electric Automobiles. Frank F. Loomis, Akron, O. Filed May 24, 1900.

688,046. Electric Signaling System. Adoniram J. Wilson, Westfield, N. J., assignor to the Hall Signal Company. Filed Oct. 23, 1900.

688,068. Interrupter. Richard H. Cunningham, New York City. Filed July 10, 1901.

688,077. Porous Diaphragm for Batteries. George T. Evanson, Philadelphia Pa., assignor to Herman J. Dercum, trustee, same place.. Filed May 17, 1901.

688,119. Electrically-Controlled Mechanism for Time-Locks. Walter Rees, Philadelphia, Pa., assignor to William H. Hollar, same place. Filed Aug. 16, 1901.

688,125. Electric-Lamp Socket. James T. Robb, Flatbush, N. Y., assignor to the Mitchell Vance Company, New York City. Filed Sept. 27, 1901.

688,170. Electric Furnace. John F. Hammond, New York City. Filed Feb. 21, 1901.

688,212-688,213. Thermostatic Fire-Alarm. Herman C. Vierkant, Tarrytown, N. Y. Filed March 18, 1901.

THE TELEPHONE WORLD.

Telephone System in the "Fire Belt."

Within a short time the new fire main system, which Philadelphia, Pa., is constructing for the protection of the business section known as the "fire belt," bounded by the Delaware River, Broad, Race and Walnut streets. will be available for use. More than half the work of laying the mains has been done, and many of the fire plugs and telephones that are to be used in connection with the service have been set up. River-front connection has been made with the system at Walnut, Arch and Race streets, and until a power house shall have been built the fireboats can be pressed into service to supply water for fire fighting purposes.

Chief Sager, of the Electrical Bureau, has perfected a telephone system in which 75 'phones are to be placed at street intersections in the "fire belt," the object being to increase the efficiency of the fire main system. By communicating directly with the power house or fireboats the firemen will be enabled to control and regulate the water pressure according to the necessity for higher or lower power. A dozen of these telephones have already been erected, and it is intended to have one at each street corner in the most crowded sections. During the progress of a fire men will be stationed at the 'phones in the vicinity, and it will be possible for any interested city official to get a detailed and exact report of the fire.

The Atlantic Coast Telephone Company, which brought cheaper rates and better service when it was established in Atlantic City, N. J., last year, has joined the Interstate Telephone Company, for the purpose of obtaining long-distance service. Reports to the effect were confirmed by President Louis Kuehnle. Mr. Kuehnle stated that the local company will retain its present corporate name and management, but otherwise will be a part of the Interstate system, now including plants in Paterson, Trenton, Millville, Vineland and other cities in New Jersey, as well as six or eight towns in Pennsylvania. The combination also has traffic arrangements with the Keystone Company of Philadelphia, and it is expected that by June 1 of next year Atlantic City will be accorded direct long-distance connection with New York and Philadelphia and all parts of New Jersey. President Kuehnle recently stated that at least $100,000 will be expended in improving the local service and carrying out the traffic arrangements with the Interstate Company. He is now seriously thinking of erecting a new central office there, the present quarters being barely adequate for the demands.

At a recent meeting the Seattle, Wash., board of public works granted permits for the erection of a large number of poles and the stringing of wires to the Sunset Telephone Company and the Seattle Cataract Company. It also gave permission to the Independent Telephone Company to construct independent conduits.

Seven independent telephone companies, including the People's, Lackawanna, Anthracite and the separate Allentown telephone companies, have combined as the Central Pennsylvania Telephone Company, with S. E. Wayland as president. The combination controls all the lines and instruments of the above-named companies and many smaller ones.

The North American Telephone Company now has poles set from the Arkansas River to the town of Savanna, I. T., a distance of 80 miles. The same company has poles set from Holdenville to South McAlester. At Holdenville the above company connects with Hummer's Oklahoma line which is now built and operating to Oklahoma City.

Current arresters are being placed on the telephones in the Troy, N. Y., city hall by the Troy Telephone & Telegraph Company. The improvement, which is done at the direction of the board of underwriters, will be made on all the metallic circuit telephones in that city as a protection against fire.

The new telephone line from Athens to Elberton, Ga., is now under headway. The new line will be completed by January 1. The work of rebuilding the Athens system is also progressing rapidly.

The Texas Telephone Company, with principal office at Wichita Falls, recently filed an amendment to its charter increasing its capital stock to $6,000.

The Hudson River Telephone Company has started a force of men at work in Middletown, N. Y., to rebuild its line, put up cables and make other improvements.

The Union Telephone and the Standard Telephone Companies are soliciting the passage of an ordinance permitting them to build a line through Chalfont, Pa.

The subscribers of the Michigan Telephone Company in Detroit are notified of a radical increase in telephone rates to take effect January 1 People who have telephones in their residences at the rate of $24 a year with the grounded circuit and Blake transmitter will hereafter have to pay $36 a year, or $9 a quarter net, the new schedule being $10 a quarter, with 10 per cent. discount for payment during the first month of the quarter. The metallic circuit and service is down on the new rate card at $11.66 a quarter, with a discount of 10 per cent. for prompt payment, making the net rate $10.50 per quarter, thus charging nearly as much for the cheaper service as for the metallic circuit. The $36 service for business 'phones with grounded circuit and Blake transmitter takes a jump to $54 a year or $13.50 per quarter net, or $15 a quarter without discount. Business 'phones with metallic circuit and long distance instruments are advanced from $72 to $80 a year, leaving the subscriber the opportunity to get the old $72 rate by taking the 10 per cent. discount for prompt payment. Extension 'phones go up from $9 a year to $12.

Northwestern officials are considering a novel arrangement for the convenience of passengers on the "Overland Limited." It is proposed to connect the train while standing in station at Chicago and in other large cities with the telephone station by special wire and movable apparatus. It is said that frequently passengers leave home for the train in a hurry and consequently forget things they want to carry with them. In this event they could telephone, and have them brought to the train. Furthermore, business men would be able to use the 'phone, either long-distance or local, to transact any business which they might have neglected. It is also possible that the company may equip the train with a telephone service of its own, to be used in transit.

Articles of incorporation have been filed with the county clerk for a charter issued by the State auditor to the Morning Sun, Ia., Telephone Company. The organization has a capitalization of $10,000. The officers of the new company are: President, Fred Courts; secretary, Guy J. Tomlinson; treasurer, Hon. E. L, McClurkin; general superintendent, B. L. DeLong. The instruments and lines centering in Morning Sun have been bought from Mr. DeLong and are now under control of the new company. New lines will be built out in the country and the present lines extended. The increasing demand for telephone service has outgrown individual interest and it was thought that the organization of a company would better handle the business.

An extension of the Duluth, Minn., Telephone Company's lines is about to be made from Two Harbors along the north shore of Lake Superior to Grand Marais. It is said that a new company will be organized to build and operate this branch of the system in conjunction with the general system. Work is to begin soon and will be completed by the opening of navigation. Thus will the north shore villages and logging interests be connected with the outside world.

The history of the independent companies since 1895, when the more important patents of the Bell Company expired, has been most interesting, showing, as it does the great advance made in both the number of instruments used, as well as in the cheapening of rates to the subscriber. The movement has been strongest and most successful in the Middle West, particularly in the suburban districts.

It is stated that the Interstate Telephone Company intends making an application for a franchise in New Brunswick, N. J. Two years ago the company's application for a franchise in New Brunswick was refused. If an application is made there is likely to be a lively fight in that city, as it is stated that some of the aldermen are in favor of competition in the telephone business.

It is rumored that Dublin, Ga., will soon have a telephone company to oppose the Bell Company, which a short time ago absorbed the Dublin Telephone Exchange, or rather formed such advantageous arrangements that there would be in Dublin no competition between the two corporations

The farmers between Sioux City and Oto, Ia., are forming a $25.000 company to put in a co-operative telephone line from Sioux City to Peiro, a new route. George Honrighause and D. Goodrich head the movement. The farmers plan to connect private 'phones all along the line.

Hutchinson, Kan., has a telephone war starting. An independent telephone exchange is almost ready to begin operations there. As a result, the Missouri & Kansas Telephone Company has begun cutting rates, dropping to less than half the price formerly charged.

The Lyons, N. Y., Telephone Company and the Wayne, N. Y., Telephone & Telegraph Company, including all rights privileges, franchises, trunk lines and local exchanges owned and controlled by H. B. and S. E. Bishop of Clyde, N. Y, have been purchased by the Eastern Electrical Construction Company of Philadelphia. The Bishop Brothers were among the pioneers in the independent telephone movement in this State. After helping to inaugurate an extensive independent system in Ulster County, which includes the city of Kingston, in 1892, they went to Clyde and organized the Wayne Telephone & Telegraph Company, which was incorporated December 17, 1895. The Lyons Telephone Company was organized and incorporated by them March 27, 1899 Larger exchanges were established in Lyons. Clyde and Newark lines built, connecting these places with Wolcott, Savannah, Rose, North Rose, Lock Berlin, Clifton Springs, Phelps, Spring Lake, Alloway and Fairville. The Eastern Electrical Construction Company has a large financial backing, and owns large telephone plants in various parts of the State, one being at Elmira. It is the purpose of the new owners to connect the local plants with their other exchanges throughout the State by copper metallic lines and furnish a first-class, up-to-date local and long-distance telephone service.

A war between the Cumber and Telephone & Telegraph Company and its subscribers at McMinnville, Tenn., seems imminent. When the Cumberland bought out the old McMinnville Telephone Company it immediately began to overhaul and improve the lines and service, putting in a new outfit throughout, and have given the subscribers notice that beginning January 1 the old rate of $1 per month for on business houses will be raised to $2.50 and the old rate of $1 residences to $2 per month. The subscribers naturally do not take kindly to the raise, and say that they will take out their 'phones before they will pay it; that the old company made a handsome profit at the old rate, and the increase proposed is unreasonable.

A Boston, Mass., report states that the Erie Telephone notes for $9,000,000 will be paid on January 10, and that there is every prospect that important banking interests will undertake the reorganization of the company.

The first directors' meeting of the Inter-State Independent Telephone & Telegraph Company, recently organized in New Jersey with $3,000,000 capital, was held in Joliet, Ill. The company decided to purchase several independent telephone systems in addition to these already owned in Joliet, Aurora, Whiteside County, and in Iowa, but the location of these companies is not made public. Officers were elected as follows: President, Senator Henry H. Evans, Aurora; vice-president, Frank Tracey, Springfield, O.; secretary and general manager, Edward R. Conklin, Joliet: treasurer, A. B. Conklin, Aurora, and general counsel, Mazzini Slusser, Chicago.

Justice McAdam of the Supreme Court of this city has granted an order dissolving the Smith-Vassar Telephone Company of No. 27 William street, and appointed Herman W. Williams receiver. Proceedings for the dissolution were begun a year ago. The company was incorporated on October 25, 1895, with a capital stock of $1,000,000. The annual report in January last showed liabilities of $100,000.

The case of the Union Telephone Company of Owosso, Mich., vs. the Michigan Telephone Company of Detroit, was settled in the circuit court lately. A year ago the Bell people began cutting out offices near Owosso, belonging to the Owosso Company, alleging it had purchased them of the New State Company. The Owosso concern secured an injunction restraining further action. Now the Union Company has put in wires and offices of its own.

TELEPHONE INCORPORATIONS.

The Carroll County Telephone Company, Bosworth, Mo. Capital stock, $1,000. Incorporators: H. A. Forsythe, R. E. Cabbell, W. P. Stout and others.

The Kansas City Home Telephone Company, Kansas City, Mo. Capital stock, $50,000. Incorporators: O. C. Snider, John Enoch, Ed. Barber and others.

The Farmers' Mutual Telephone Company, New Sharon, Ia. Capital stock, $4,500. Officers: Noah Yoder president, J. R. Roberts vice president, S. H. Cox, secretary and E. C Stuttsman treasurer.

The Sioux City & Black Hills Telephone Company, Ponca, Neb. Capital stock, $100,000. Incorporators: F. B. Rowe, E. E. Halstead and J. McCarthy.

The Harrison County Mutual Telephone Company, Brookline, Mo. Capital stock, $9,000. Incorporators, Archie Scott, Lewis Marrs, P. H. Russ and others.

The Rollin Telephone Company, Town House, Mich. Capital stock, $10,000.

GENERAL ELECTRICAL NEWS.

Lighting.

Bennettsville, S. C.—The citizens have voted the issuance of bonds for the installation of an electric light plant.

Boyne City, Mich.—The council has made a contract and gave a 30-year franchise for street and commercial electric lighting with W. H. White & Co.

Bryn Mawr, Pa.—John D. Rockefeller has answered the cry of Bryn Mawr College for money to erect a student's dormitory on the college campus. For this purpose and also to build a heating and electri light plant Mr. Rockefeller has given $230,000 to the institution.

Camden, N. Y.—At a meeting of the board of village trustees a resolution was passed to issue a call for a special election to be held soon for the purpose of submitting the question of a municipal electric lighting plant calling for an appropriation of $18,000.

Center, Tex.—W. N. Bailey of Nacogdoches, is investigating with a view to establishing an electric light and ice plant here.

Concord, N. H.—The Penacook Electric Light Company has increased its capital stock to $30,000.

Covington, O.—At a recent meeting of the general council and the committee of the Business Men's Club a plan was arrived at whereby the citizens will in all probability obtain a perfect system of electrical illumination of the city.

Crystal Falls, Mich.—The common council has declared for municipal lighting and it has been decided to establish an electric plant to be operated in conjunction with the waterworks system. The improvement will cost about $25,000.

Dallas, Ore.—The city council will be petitioned at its next meeting to purchase the electric light plant now operated by a local company. A petition to this effect is in circulation and is being generally signed.

Dunlap, Ia.—This town is agitating the question of an electric light plant.

Elmer, N. J.—Parties have been here with a view of installing an electric light plant.

Glen Ellyn, Ill.—The citizens of this place are agitating the question of issuing bonds for an electric light plant.

Harrisburg, Pa.—The Citizens' Light, Heat & Power Company has purchased land and is making surveys preparatory to the early erection of a gas and electric light plant.

Lost Nation, Ia.—The citizens are agitating the question of the establishment of electric lights.

Minneapolis, Minn.—A resolution will be submitted to the council to submit to a vote of the people a proposition to issue $300,000 in bonds for a municipal lighting plant.

New Albany, Ind.—The contract for installing the plant of the Borden Electric Light Company has been awarded to O. C. Thompson, of this city, and it will be in operation by January 1.

New Haven, Conn.—Contracts have been nearly completed for the installation of a giant electric light and power plant in the new shops of the New York, New Haven & Hartford Railroad Company at Readville, Mass. The plant will not only illuminate the shops but will also manipulate all the shop machinery.

New Orleans, La.—This city contemplates constructing an electric light plant.

New Ulm, Minn.—This city has issued $30,000 in bonds for an electric light plant. Plans have been prepared by Chas. L. Pillsbury of Minneapolis.

Oxford, Pa.—Plans are being prepared by the big local steel company for lighting the town with electricity.

St. Louis, Mo.—The Citizens' Electric Lighting & Power Company has completed plans for a large electric light and power plant on its property. The plant when completed will involve an outlay of $2,000,000.

Wampum, Pa.—This place is soon to be illuminated by electric light. A company composed of H. S., F. M., G. E., F. R. and L. E. Miles has been formed and has obtained a right of way for poles and wires through the town from the borough council. Application for a charter has been made.

Waynesboro, Ga.—The city will issue bonds for the construction of waterworks and an electric light plant. The mayor can be addressed.

Street Railways.

Albany, N. Y.—The People's Traction Company of New York City has leased its property and franchises to the Interurban Street Railway Company for a term of 999 years, according to a certificate filed December 5 with the Secretary of State.

Alderson, I. T.—St. Louis and Texas capitalists are figuring on constructing a system of electric railroad to connect South McAlester with Krebs, Alderson and McAlester.

Canton, O.—Protracted negotiations have resulted in the transfer of the Canton-Massillon Electric Railway to Philadelphia parties. The property consists of local lines in this city and Massillon and an interurban line of eight miles, and also an interurban line from Massillon to Navarre, five miles. It is said the purchasers are closely associated with the Elkins-Widener syndicate of Philadelphia, and there is a well-defined rumor that the Northern Ohio Traction Company will take formal possession within 30 days.

Charlotte, Mich.—The council has granted a franchise to the Central Michigan Traction Company. An electric railway from Jackson to Grand Rapids is to be built.

Danville, Ky.—An electric line connecting this city with the Louisville & Nashville Railway at Junction City, and moving it 30 miles nearer to Louisville, is now a certainty.

Exeter, N. H.—Wallace D. Lovell of Newton, Mass., has disposed of his electric railway system to the New Hampshire Traction Company, composed of New York and Boston capitalists.

Lansing, Kan.—Willard W. Winner, the electric line promoter, will appear before the board of county commissioners of Leavenworth County soon and ask for a franchise to build an electric line from here through the county, passing by Fairmount, Basehor, Tonganoxie and to the Kaw River.

Lexington, Ky.—The capital stock of the Georgetown & Lexington Traction Company has been increased to $2,500,000.

Lima, O.—The Western Ohio Railway Company of this city has increased its capital stock from $1,000,000 to $3,000,000 and secured the additional right to construct electric lines from Wapakoneta to Shelby, St. Mary's to Celina, and from Celina to a point on the west line of Mercer County.

Newport, Ky.—A. S. Berry and others of this place are interested in a proposed electric railroad between Fort Thomas, Alexandria and Cold Springs, and a company may be formed in the near future to take up the project.

New York City.—The American Standard Railway Company of this city has been formed to construct electric railways on a capital of $50,000. G. L. Campbell, Nyack; W. J. Brooks, New York City; W. C. Herr, Strasburg, Pa., are the directors of the concern.

Phillipsburg, N. J.—A certificate of incorporation of the Phillipsburg and Washington Street Railway Company was recently filed at Belvidere, with a capital of $500,000. The incorporators are Robert E. Wright, of Allentown, Pa.; C. M. Bates, of Brooklyn, N. Y.; and William M. Davis, of this place. The company proposes to extend the trolley line from here to the cement industries at Alpha, Vulcanite and Washington.

Pittsburg, Pa.—Stockholders of the Philadelphia Company met last week and formally voted on the $115,000,000 trolley and light deal which has been under discussion here several months. Out of a total of 375,460 shares of stock 302,808 were represented, the vote being unanimous on the three propositions submitted

Princeton, N. J.—Tom Johnson's trolley syndicate scored a decisive victory over the authorities of Princeton University and former President Cleveland last week, when the town council passed the ordinance permitting the trolley road to enter Princeton through Witherspoon street.

Somerville, Conn.—The Hartford & Springfield Street Railway Company is said to be negotiating for the purchase of the charter for the construction of an electric railway between Thompsonville and this place. The road will probably be built and in operation within a year.

Manufacturing.

Lincoln, Neb.—The Nebraska Electrical Company, capitalized at $25,000, has been incorporated by Samuel G. Musser, Clinton C. Burr and George W. O. Farnham, to deal in and manufacture electrical supplies.

Manchester, Conn.—The Norton Electric Instrument Company of this city has filed a certificate of incorporation in the office of the Secretary of State. It has a capital of $10,000, and will deal in and manufacture electrical supplies and motive power.

Company Matters.

Cincinnati, O.—The Consolidated Gas & Electric Light stockholders have been called to meet January 8, to decide on the issue of $1,000,000 of new stock proposed by the directors.

La Crosse, Wis.—The Central Electric Company of this city has increased its capital stock from $25,000 to $50,000.

Savannah, Ga.—The Savannah Electric Company has been formed and will consolidate and improve the electric interests of this city, which will be bonded for about $7,000,000.

York, Pa.—The Arrowsmith Electric Company, of Reading, which has a branch establishment in this city, was recently incorporated with a capital of $100,000.

Mines.

Oxford, Pa.—A plant will be built to light up the mines and mills and run the machinery by electricity.

Port Townsend, Wash.—Advices from Douglas Island state that the Treadwell Mill will soon be operated by electricity. The company is negotiating with the owners of the Sheep Creek water power for the installation of a large plant on that stream for generating electricity, which will be conducted across Gastineaux Channel by cable, a distance of four miles, to the Treadwell plant. The Treadwell Company operates 1,000 stamps, and the importation of a large amount of coal is required. With the introduction of electricity for power this expense will be overcome, and the cost of milling ore will be reduced about one-half.

Automobiles.

Bellefontaine, O.—At the session of the Bellefontaine Commercial Club the president stated that Mr. Miller, of Kenton, had signified his intention of coming to Bellefontaine to start a factory to manufacture automobiles and electric storage batteries. On motion of Mr. Brand the matter was referred to the committee on new industries. There is talk of organizing a local company to operate this factory and the suggestion was made that A. J. Miller be made president.

Memphis, Tenn.—The charter of the Menges Engine & Manufacturing Company was lately filed in the register's office, with the following incorporators: A. C. Menges, W. E. Graves, J. S. Moody, N. Nelson and A. L. Cross. The capital stock is $5,000, and the company will manufacture engines, automobiles and electric light plants.

Springfield, O.—Jesse French, the head of an automobile factory in St. Louis, has recently been here and thinks this city a desirable place in which to locate a factory for the manufacture of horseless carriages.

St. Louis, Mo.—Automobiles will be running on Eads Bridge, to carry passengers from State to State, by March 1. The Interstate Transit Company has been incorporated in Illinois with $200,000 capital, furnished by St. Louisans, to operate an automobile passenger line on the bridge.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, December 9, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	33	36
Broadway and Seventh Avenue	100	248	249
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	180	190
Dry Dock, East Broadway and Battery	100	120	130
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	160¼	160¾
Ninth Avenue	100	196	205
Second Avenue	100	217	220
Sixth Avenue	100	175	215
Third Avenue	100	120	120¼
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	102	103
Brooklyn City Railway	100	242	243
Brooklyn Rapid Transit	100	63⅛	63¼
Baltimore United Railways, com	50	15⅝	15½
do. do. do. pref	50	91	92
Buffalo Railway	100	99	101
Cleveland City Railway	100	109	110
Cleveland Electric Railway	100	85⅝	87½
Columbus (O.) Street Railway	100	43	49
Jersey City, Hoboken and Paterson	100	16	20
New Orleans City Railway, com	100	26	27
do. do. do. do. pref	100	102	106
North Jersey Street Railway	100	22½	24
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	38	40
do. do. do. pref	100	94	96
St. Louis United Railways, com	100	35⅞	36
do. do. do. pref	100	89¾	60¼
United Electric of New Jersey	100	281	282
PHILADELPHIA.			
American Railways	50	43¾	43
Citizens	50	359½	360
Columbus Railway	100	45	45½
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	65	67
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23	23½
do do pref	50	63	63¼
Dayton Traction	100	156	156½
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151½
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205½
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	97⅞	98
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	308½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	32½	33
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	165½	166
West End Street, com	50	94	94¼
do. do. do. pref	50	113½	114
CHICAGO.			
City Railway	100	185	185½
Lake Street Elevated	100	11½	11⅝
North Chicago	100	190	200
Union Traction, com	100	10⅞	11
do. do. pref	100	51	51¾

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23	23½
do. do. do. pref	50	64	64¼
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	47	48

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Asked.
NEW YORK CITY.			
Electric Boat, com	100	19	22
do do pref	100	45	50
Electric Lead Reduction	100	2	2¼
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	3	3½
do do pref	100	4	5
General Carriage	100	1⅝	1½
General Electric	100	281¼	281½
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	241	245
General Electric	100	281¼	281½
Massachusetts Electric Companies, com	100	30¾	31
" " " pref	100	94	94¼
Westinghouse Electric & Mfg., com	50	73	73¼
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	155	156
National Carbon, com	100	19⅞	20
do do pref	100	83	84
PHILADELPHIA.			
Electric Company of America	50	6	6
Electric Storage Battery, com	100	63	66
do do do pref	100	64½	66
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	4½	4⅞
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	197	200
Narragansett Electric Company, Providence	50	92	93
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Asked.
BOSTON.			
American Telephone & Telegraph Company	100	160	160¾
Erie Telegraph & Telephone Company	100	17	19
New England Telephone Company		133½	13¾3
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co.	100	107	110
Commercial Cable Company	100	175	184
Franklin Telegraph Company	100	47	55
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	120	123
Mexican Telephone Company	100	2	2⅛
New York & New Jersey Telephone Company	100	167	170
Pacific & Atlantic Telegraph	25	78	83
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		91⅛	91¼
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	106	109
Cumberland Telephone & Telegraph Co	50	133¼	133
Chesapeake & Potomac Telephone Company	100	72	75½
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		78	84
Hudson River Telephone Company	100	100	105
Northwestern Telephone Company, guar	50	122	126
Providence (R. I) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	..

ELECTRICAL SECURITIES.

Closing Prices, Monday, Dec. 9

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1½	2
Eddy Electric Manufacturing Company	25	8	8¼
Storey General Electric	10	9	12
Consolidated Car Heating	100	50	55
Standard Underground Cable	100	180	190
Pratt and Whitney, pref	100	84	92

STREET RAILWAY BONDS.

	Last Sale.	Int. Paid.
ALBANY.		
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	[98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent.	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116¼	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120¾	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100¼	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 16⅜@16⅝c.; Lake, 16¾@17c.; casting, 16¼@16⅜c.

The Canton-Massillon (O.) Electric Railway has been transferred to Philadelphia interests.

The Electric Company of America has taken possession of the Altoona (Pa.) Edison Company.

The strike of street car employes of Reading, Pa., which has been in progress for three months, was declared off Saturday.

It was announced authoritatively on Monday that the Edison Illuminating Company has acquired the street railways at Savannah, Ga.

The General Electric Company has declared the regular quarterly dividend of 2 per cent. on its common stock, payable January 15 to stock of record December 31.

The Pennsylvania Electric Vehicle Company will reduce the par value of its $6,000,000 capital stock from $50 to $10 a share. The step will save $3,000 a year in taxes.

The Philadelphia Company of Pittsburg has declared the regular quarterly dividend of 1½ per cent. on its common stock, payable January 15, to stock of record December 20.

The United Gas and Electric Company, capital, $4,000,000, was incorporated in New Jersey on Monday. The incorporators are John D. Fearhake, Frank B. Pierce and Edward P. Meeker.

The United Traction Company, of Albany, N. Y., for the four weeks ending Saturday, November 23, showed an increase in gross earnings over the corresponding period last year of $1,700.96.

The Twin City Rapid Transit Company has declared the regular quarterly dividend of 1¾ per cent. on its preferred stock, payable January 2. Books close December 23 and reopen January 2.

The directors of the Chicago Telephone Company voted to increase the capital stock from $9,000,000 to $12,000,000. The new issue will be offered to holders at par in proportion of one new share for each three of old.

Christmas presents in dividends and interest amounting to more than $48,000,000 will be paid this month. This is about $6,000,000 more than was disbursed last year, the payment of which was considered a record breaker. January disbursements will amount to fully $125,000,000.

The Cleveland & Buffalo Transit Line directors have voted to increase the capital stock from $700,000 to $1,000,000. A regular quarterly dividend of 1¼ per cent. and an additional dividend to distribute the surplus, which had been earned on account of the Pan-American Exposition, were declared.

A Pittsburg dispatch says the stockholders of the Philadelphia Company voted to conclude negotiations whereby all the traction lines in Allegheny County, except the West End Company, will come under the control of the Philadelphia Company. They also voted to increase the capital stock from $21,000,000 to $36,000,000 and to increase the bond issue from $6,500,000 to $22,000,000.

The Marietta, O., electric lines have been sold to the Parkersburg Interurban Lines through the latter's representative, C. R. Shattuck, of Parkersburg. The consideration is approximately $400,000, the money to be paid by December 20. The local lines will be consolidated with the Parkersburg system, and the lines in the two cities, besides the connecting road to be built between Marietta and Parkersburg by the latter concern, will all be under one management.

On Saturday last the first papers were sent to Springfield, Ill., for the incorporation of the Automatic Electric Company of Chicago, with a capital of $2,000,000. It has secured manufacturing rights for the United States and the plant of the Strowger Automatic Telephone Exchange. The incorporators are: Edwin W. Gearhart, James C. Law, Albert G. Wheeler, Jr., Thomas H. Watkins, Scranton, Pa.; Charles E. Eddy, and J. B. Russell & Co., bankers, of Wilkes-Barre, Pa.

Amalgamated Copper dropped to 65 Monday and then went up to 71. The stock went up, it is said, "because the Rothschild mines had agreed to limit the output of their Rio Tinto mine and be content with the lion's share and not the whole of the copper trade of Europe; the stock went up because a Pacific cable is to be laid, and there will be a demand for 4,000,000 pounds of copper; the stock went up because a man with the power knew that another man was short of it and was so involved that a rise where he looked for a fall meant ruin to him." There are 14,000 stockholders of Amalgamated Copper, and the amounts lost in the cities where the larger blocks of the stock are held are estimated at $100,000,000. The heaviest losers are in the New England States.

At an adjourned meeting of the stockholders of the Edison Electric Illuminating Company of Boston, the amount of the capital stock of the corporation was increased from $7,102,700 to $7,850,400. The directors of the company offer to stockholders of record December 4th 7,477 shares of the capital stock of the company at $200 per share at the rate of two new shares for every nineteen old shares now held by them. The right to subscribe will expire at the close of business January 10, 1902, and all subscriptions and all assignments of rights must be received at the office of the Old Colony Trust Company of Boston on or before that date. Payment for the shares subscribed for must be made as follows: Thirty per cent. on or before February 1, 1902, and the remainder, or 70 per cent., on or before May 2, 1902, on which date certificates will be issued.

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EDITORIAL NOTES.

Copper Cut After Big Losses.

Public announcement has been made by the Amalgamated Copper Company of a reduction of 1¼ cents a pound in copper products—electrolytic now being quoted at 15 @ 15¼ cents. The cut will undoubtedly reduce the dividend of Amalgamated stock—and this, too, after investors have suffered a loss of over $100,000,000.

The manipulation of the stock by the Wall Street gamblers is nothing more than an economic crime and has startled the financial world. Electricity has warned the public many times about the over-capitalization of industrial stocks, and has shown that the governors of the Stock Exchange were derelict in their duty in listing over-capitalized securities, and thus giving a nest of unscrupulous gamblers an opportunity for trading on the gullibility of the public.

The "copper deal" has called forth the following from a leading member of the Stock Exchange:

"You have no idea what great losses have been taken in Amalgamated by the outside public. Hundreds of people, many of them women, were induced to purchase the stock at high prices because of the respectability of the names of the controlling interests, and through the many alluring promises held out that the stock was 'on its way to 200, and in time would become a second Standard Oil.' When the bottom dropped out, many of these people—some of them who owned their stock outright—took their losses, not a few of them because at the offices of the company and by interests identified with the property all information as to the condition of the property and of the trade was refused—refused, mark you, to stockholders. Some of the more daring speculative holders refused to sell, and hence it is that with every further drop in the price money is being forwarded from Chicago, Cincinnati, New Orleans and a dozen and one other cities to furnish additional margin. But the total of the losses taken by legitimate investment holders (apart from speculators) has been simply enormous.

"Of course such a thing would never have happened if the management had been open and honest.

"For my own part, I don't see how the stock was ever admitted to the Stock Exchange. The statement furnished at the time was practically no statement at all, but the 'guardians of the public's interests'—that is to say, the governors of the Stock Exchange—apparently shut their eyes to this neglect. I wonder why."

* * *

A Department of Commerce and Industries.

It is quite evident that a determined effort will be made in Congress during the present session to secure the passage of a bill creating a new executive department to be known as the Department of Commerce and Industries. During the first week of the session six or more bills with this object in view have been introduced and referred to the proper committees. That of Senator Nelson, who is chairman of the Senate Committee on Commerce, and a staunch advocate of the proposed department, will probably be selected for enactment. Senator Nelson's bill provides for a Secretary of Commerce, who shall have a place in the President's Cabinet, and whose province and duty it shall be to foster, promote, and develop the foreign and domestic commerce, the mining, manufacturing and shipping industries, the labor interests, and the transportation facilities of the United States; and to this end the department shall be vested with jurisdiction and control of the departments, bureaus and branches of the public service which have heretofore had control of these matters. A branch of the proposed department, to be known as the bureau of manufacturers, is to be vested with the duty of promoting and developing the various manufacturing industries of the United States, and markets for the same at home and abroad, by gathering and supplying all available and useful information concerning such industries and such markets.

The need for this new department was well expressed in the resolutions adopted by the National Reciprocity Convention, held recently in Washington. President Roosevelt also recognizes the great and growing need for the new department and in his first annual message to Congress strongly recommended the enactment of a law to create the department of commerce, "for the purpose of broadening our markets, securing our business interests on a safe basis, and making firm our new position in the international industrial world."

The electrical fraternity is vitally concerned in this matter and no doubt will lend its influence and aid to the movement now well under way to secure the enactment of the pending legislation.

* * *

The Gigantic Projects of the Pennsylvania Railroad.

This is certainly an era of gigantic undertakings, at least so far as New York City is concerned. The elevated railroads are being converted from steam as motive power to electricity, the underground rapid transit tunnel is being pushed ahead with vigor, and now it is announced that the Pennsylvania Railroad Company proposes to have a terminal in the heart of the city, and with this object in view will not only burrow under the Hudson River, but under the East River as well, in order to connect with Long Island, through the medium of the Long Island Railroad Company, which it is understood, the Pennsylvania now controls. To carry out this plan there was incorporated at Albany last week the Pennsylvania New York Extension Company, with a capital of $1,000,000. Referring to the proposed change, President Cassatt, of the Pennsylvania Railroad Company, is reported as saying:

"The Pennsylvania Railroad Company is now prepared to carry out its policy, long since adopted, of extending its railroad into New York City and therein establishing a suitable passenger terminus for the accommodation of the public.

"To accomplish this on a comprehensive plan the Long Island Extension Railroad Company will withdraw its application for powers to construct its terminal railroad, and in lieu of such independent construction it is now proposed to build, under the charter of the Pennsylvania New York Extension Railroad Company, just organized, and a New Jersey Railroad Company, about to be organized, a through underground connection between the Long Island Railroad and the Pennsylvania lines in New Jersey, and to construct a proper and commodious joint underground terminal station in New York City for the Pennsylvania and Long Island roads.

"After years of exhaustive study, the conclusion has been reached that a tunnel line, operated by electricity, is in every way the most practical, economical and the best, both for the interests of the railroad company and of the city. The line as adopted will traverse the City of New York from the Hudson River to the East River, and be underground throughout, and at such depth as not to interfere with future construction of subways by the city in all its avenues similar to the one now building along Fourth avenue.

"As the railroad will be wholly underground and operated electrically, in the same manner as the recently constructed Orleans Railway Extension in Paris, it will not be objectionable in any way. There will not be any smoke, dirt or noise, and as all the surface property may be built upon after being utilized underneath for railroad purposes, the neighborhood of the station will be improved instead of marred, as is so often the case when railroad lines are constructed on the surface or are elevated.

"The company has acquired the bulk of its property for its principal station, and means to go forward in the acquisition of such additional properties as will be required, either by purchase or condemnation, in the belief that the city authorities will meet its application in a spirit of fairness and expedite as much as possible this much needed improvement and great public convenience. Immediately upon the necessary authority being granted the work of construction will proceed and the whole line be completed and put in operation as soon as possible."

Although the company incorporated to carry out the undertaking is only capitalized at $1,000,000, the cost of the entire project will, it is estimated, be in the neighborhood of $50,000,000. The Pennsylvania expects to reap a good return on the investment by being able to distance its competitors in carrying freight from the West right into New York City and passengers from Chicago to Montauk Point without change of cars. It is also possible that in the not very distant future Montauk Point may be made a docking place for ocean steamships, in which case the Pennsylvania's extension of its transportation system to the end of Long Island would prove of great advantage.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

According to a dispatch from Brussels, received on Monday, Dr. Sylvestre, formerly an American but now a naturalized French physician, has invented a spectograph, the "Independence Belge" says, which enables users of the telephone to see each other.

◆

A number of Nernst lamps have already been installed for street lighting in Farmington, Conn.

◆

The following are the new officers for the Chicago Electrical Association: Prof. P. B. Woodworth, president; C. Wiler, vice-president; H. G. Dimick, treasurer; W. B. Hale, secretary and librarian; A. M. Blumenthal, auditor; R. F. Schuchardt, J. G. Wray and C. H. Roth, directors.

◆

Charles T. Yerkes has awarded to the British Westinghouse & Electric Mfg. Company the contract for electric equipment for the power houses for the London underground roads.

◆

The speculators who have felt the shock should meddle only with properly insulated copper hereafter.—N. Y. "World."

◆

No less a project than electric railways between Cornwall and Toronto, 266 miles, and Brockville and Ottawa, 60 miles, is contemplated by the Ontario Electric Company, which seeks incorporation at the coming session of the Ontario Legislature. Among the names associated with this enterprise are A. L. Jewell, banker, and Geo. E. Smith, electrician, both of Boston, Mass. The company seeks power to construct and work a railway operated by electricity, compressed air or any other power except steam.

◆

Among the Christmas novelties may be found an electrical top which consists of a tiny toy dynamo with the armature revolving horizontally on a vertical shaft, and driven by a dry or other battery. The upper end of the spindle is adapted to receive disks which are placed over it and fitting snugly in a grooved pulley. Over this is placed a black card which has two sections cut from it. The top having been connected to the battery is ready to spin and is set in motion by giving a twist to a knob which is removably fitted on the end of the spindle, covering the center of the disks and holding them firmly in place.

◆

William A. Eddy of Bayonne, N. J, says that he is writing to Signor Marconi, who is at St. John's, N. F., experimenting with wireless telegraphy, inclosing diagrams of an improved tandem-kite system for reaching a height of 3,000 feet with Major Baden-Powell's kites. He thinks this system will enable Marconi to send messages at least 1,000 miles, because every increase in height has so far enormously increased the range of wireless telegrams.

◆

The question of electrifying the entire system is now engaging the attention of the officials of the London and Northwestern Railway, the greatest railroad in the United Kingdom. The matter seems to have reached such advanced stages as to justify its mention in the financial columns. The "Globe" says that the directors and the experts who were summoned for consultation are reported to have formed the opinion that, if electrified, the road could considerably accelerate and cheapen its service.

◆

In a recent dispatch from Paris it was stated that the International Exposition of Automobiles was opened by President Loubet last week. All Paris was there; members of the Jockey Club and the Rue Royale were especially notable. The exhibits of the Minister of Posts and Telegraphs included types for use between urban postoffices and in transit to railway stations. At no time has there been brought together such a number of utilitarian motors.

◆

The buildings of the Pan-American Exposition, at Buffalo, have been sold for $130,000 to the Chicago House-Wrecking Company, the same concern which wrecked the buildings of the World's Fair in Chicago. It is expected that the demolition of the buildings will begin soon.

◆

"Germany is putting forth every effort to take advantage of the commercial opportunities offered in Southern Brazil," says United States Consul Winter, at Annaberg, in a report to the Department of State. "There are," continues Mr. Winter, "more than 300,000 Germans located in Southern Brazil, and in Santa Catharina and Rio Grande do Sul thriving colonies have been established. The city of Porto Alegre, it is stated, contains 33,000 German inhabitants, who carry on a foreign commerce valued at $25,000,000 annually. German capital is said to be everywhere in evidence in the establishment of steamship lines and banks, and the construction of railroads, bridges, electric plants, factories, canals and the like."

◆

In a report to the State Department at Washington, D. C., dated November 21, W. W. Canada, United States Consul at Vera Cruz, Mexico, says the Mexican Government has contracted with the Safety Insulated Wire and Cable Company of New York for a submarine cable to be laid between Vera Cruz, Frontera and Campeche. The cable is to be

472 nautical miles long; there must be enough to reach a depth of 49 feet in the port of Campeche and 65 feet in the ports of Vera Cruz and Frontera. It is to be made of nine copper wires, protected by sixteen galvanized iron wires for the deep sea and eighteen additional steel wires for the coast. The manufacture of the cable will be under the supervision of the Mexican Government. The company is to receive for the work $600,000 in gold, of which $283,000 is to be paid when the cable is placed in service, and the balance in two and four months thereafter. The cable must be ready for service on April 2, 1902.

Progress with the construction of the African trans-Continental telegraph has been so marked of late that the line is now practically completed from the Cape to Lake Tanganyika, says the London "Electrical Engineer." Latest advices state that the line has now reached Ujiji, a place about two-thirds of the way up the east coast of the lake. It is at Ujiji that an important junction with the German East African system from Dar-es-Salaam is contemplated. After reaching the northern extremity of Lake Tanganyika, the telegraph will turn to the northeast to join up with the line which already exists between the western shores of the Victoria Nyanza and the coast..

A joint resolution introduced in the House of Representatives in Washington by Mr. Otey of Virginia provides that there be erected in rear of the Speaker's desk and directly in front of the main entrance such electrical devices and appliances, which, being connected with the desk of each member by wire, will enable him to touch a button and display his vote "aye" or "no" by small incandescent lights.

At least one system has already been employed by means of which a section of trolley wire is automatically cut off from the circuit when it breaks, and part of it therefore carries no current, says the London "Electrician." This is accomplished by means of an auxiliary wire, brought back from the far end of the section to a cut-out situated at the beginning of the section. An arrangement devised by Messrs. Siemens and Halske, and described in the "Elektrotechnishe Rundschau," extends the application of this system to other overhead circuits than trolley wires employing only one cut-out wire for the whole group of conductors. The arrangement consists, in the case of a two-wire system, of connecting a resistance or battery across each end of the section to be protected, a connection being made between the middle points of these through the coil of the cut-out. This cut-out controls contacts in the main circuit. Normally, the two ends of the auxiliary wire being at the same potential, no current passes through the cut out, but as soon as one of the main wires is broken a current passes through the circuit formed of the sound wire, half the resistance or battery at each end, and the cut-out and its wire. The cut-out thereupon acts, and the main circuit is broken. It will be seen that the system is precisely similar to the expedient frequently employed on telephone interchange lines for giving a clearing signal automatically as soon as the connecting plug is removed. Similar arrangements can be made in circuits of more than two wires. For instance, in the case of a three-phase system, one end of the cut-out wire could be connected to the neutral point of the generator and the other to the neutral point of an artificial—or even a useful—three phase load. It is pointed out that the resistance load, to the middle point of which the auxiliary wire is connected need in no case be an artificial one, and, moreover, that capacities or inductances can take its place on alternating-current circuits.

In the electric automobiles which are being built this season at the plant of the vehicle company in Hartford, Conn., several departures from previous models are being featured. The weight of the battery instead of resting on the rear wheels is divided, half being carried on the forward truck. It is contended that the division will be of advantage in hill climbing. The Hartford vehicles have previously been equipped with large single motors, but now small twin motors, directly connected, are being employed. It is claimed that economy in space and in the consumption of electricity is promoted. Another departure is that, as the result of tests made in the fall, solid steel bars instead of tubing are being used for axles.

MARCONI SAYS HE HAS RECEIVED WIRELESS SIGNALS ACROSS THE OCEAN.

Guglielmo Marconi telegraphed from St. John's, N. F., on Saturday night that he had received electric signals across the ocean from his station in Cornwall, England.

Signor Marconi explains that before leaving England he made his plans for trying to accomplish this result, for, while his primary object was to communicate with Atlantic liners in midocean he also hoped to receive wireless messages across the Atlantic.

The Marconi station in Cornwall is a most powerful one. An electric force a hundred times greater than at the ordinary stations is generated there. Before he left England, Signor Marconi arranged that the electrician in charge of the station, which is located at Poldhu, should begin sending signals daily after a certain date, which Signor Marconi was to cable to him upon perfecting the arrangements at St. John's, where he arrived two weeks ago. He selected Signal Hill, at the entrance to the harbor, as an experimenting station, and moved his equipment there. On Monday of last week he cabled to the Poldhu station orders to begin sending signals at 3 P.M. daily and to continue them until 6 P.M., these hours being respectively 11:30 A.M. and 2:30 P. M., St. John's time.

During these hours last Wednesday Signor Marconi elevated a kite, with the wire by means of which signals are sent or received. He remained at the recorder attached to the receiving apparatus, and, to his profound satisfaction, signals were received by him at intervals, according to the programme arranged previously with the operator at Poldhu. These signals consisted of the repetition at intervals of the letter "S," which in Marconi's code is made by three dots or quick strokes. This signal was repeated so frequently, and so perfectly in accord with the detailed plan arranged to provide safeguards against the possibility of a mistake, that Signor Marconi was satisfied that it was a genuine transmission from England.

Again on Thursday, during the same hours, the kite was elevated and the same signals were renewed.

This made the assurance so complete that Signor Marconi cabled word of his success to his principals in England, and also made it known to the Governor of Newfoundland, Sir Cavendish Boyle, who apprised the British Cabinet of the result of the experiments.

Signor Marconi, though satisfied of the genuineness of the signals and that he had succeeded in his attempts to establish communication across the Atlantic without the use of wires, emphasizes the fact that the system is yet only in an embryonic stage. He says, however, that the possibility of its ultimate development is demonstrated by the success of the present experiments with incomplete and imperfect apparatus, as the signals can only be received by the most sensitively adjusted apparatus, and he is working under great difficulties owing to the conditions prevailing there. The Cornwall coast is 1,740 miles from St. John's.

In view of the success attending these trials, Signor Marconi will for the present disregard the matter of communicating with transatlantic steamers. He will return to England this week, and will conduct the experiments from Poldhu. He explains that the greater electrical power there will enable him to send more effective signals. He will undertake this work himself, leaving assistants at St John's to erect a mast and receive the signals as he forwards them. It is not possible to send return signals from St. John's until a powerful electric battery shall have been installed.

Premier Bond of Newfoundland offers to Signor Marconi every facility within the power of the Colonial Government for the carrying out of his plans.

Signor Marconi intends to build a large, fully equipped experimental station near St. John's, besides the Lloyd station at Cape Race. The former will have the same equipment as the Poldhu station, and will play the same part on this side of the Atlantic as Poldhu does on the other side. It is expected that the St. John's station will communicate with New York on one side, and Cornwall on the other, being midway between the two. This establishment will probably cost about $60,000, and is intended to perform the same work as a modern cable station.

Signor Marconi announces that he will remain in England until after the coronation of King Edward next summer, and that he hopes to send the news of that event across the Atlantic by the wireless method, so as to prove the capability of the system for such purposes.

Trouble for Marconi.

St. John's, N. F., Dec. 16.—On returning here from Cape Spear to-day Signor Marconi was served with legal documents from the solicitors of the Anglo-American Telegraph Company. These notify him that the company possesses a monopoly of the telephone business within Newfoundland and its dependencies, and demand that he cease his experiments and remove his apparatus forthwith, else th pany will apply to the Supreme Court for an injunction restraining him from further trials.

THE "POTTER" MESH SEPARATOR AND SUPERHEATER.*

BY FREDERICK A. SCHEFFLER.

Various designs of dry pipes have been made, all of them with a view of accomplishing the same result, namely, that of affording a receptacle for the steam passing out of the boiler, and so devised that steam only, and no water, should pass through the dry pipe. The very fact that these various forms of dry pipes (sometimes deflectors were used) have been changed in design, and also that in many instances the dry pipe has been abandoned for another device equally deceptive, without eliminating the difficulty, is proof that none of the old methods were satisfactory under all circumstances, and that a form of dry pipe which might be suitable in one case would not apply in another equally well.

I have no doubt that many members in reading or discussing this paper can recall their experience with priming or foaming boilers, and what they did to prevent disastrous accidents from occuring to their engines and other machinery. This is an experience which many of us have had.

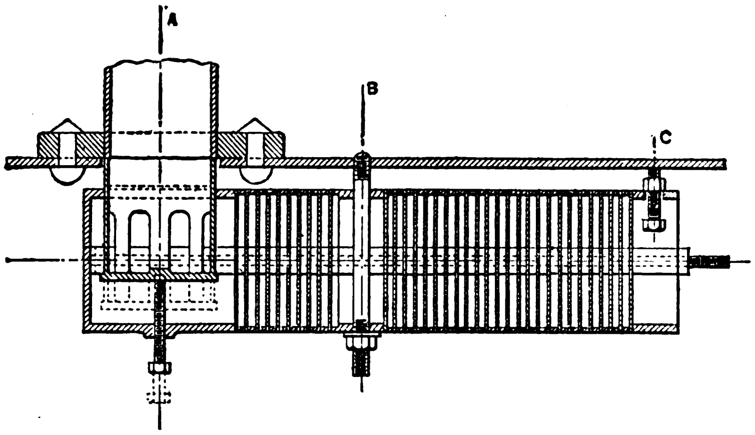

FIG. 1.—POTTER MESH SEPARATOR—LONGITUDINAL SECTION.

It is a well-known fact that under certain operating conditions even the best designed boiler is likely to "throw water," or prime or foam badly. This may be due to various causes, which we have not the time to discuss now, and frequently is not due to improper construction of the boiler.

The "Potter" mesh separator is designed to prevent the trouble above referred to from occurring within the boiler itself, and while boilers equipped with the apparatus may prime for various reasons, the separator makes it impossible for the boiler to "throw water." The device is placed in the steam space of the boiler, and is connected in a manner similar to a dry pipe, or it can be connected to the end of the dry pipe, and the holes in the latter stopped up.

The construction of the separator is shown in longitudinal sectional elevation (Figs. 1 and 2), and consists of a series of galvanized or copper wire meshes or screens placed alternately between rings of cast iron, there being generally from 25 to 30 layers of mesh. The area of the screens depends on the size of the boiler outlet.

After considerable interesting experimental work, involving many other designs, more or less complicated, the above construction is found to fulfill all conditions of priming, over-saturated steam, etc., and delivers at the boiler outlet practically dry steam.

It has also been found by careful experiment that, given any boiler from which steam is delivered at any particular range of moisture (with or without "dry pipe"), the introduction of the mesh separator in the same boiler will change the quality of the steam by from 25 to 75 per cent. (making it drier), and at the same time stop any priming which may have been present.

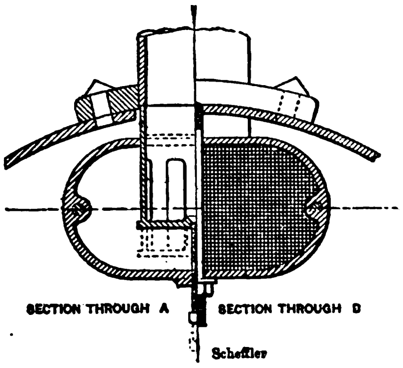

FIG. 2.—CROSS SECTION.

The theory on which the action of this separator is based is, as may already have been surmised, that the small globules of moisture contained in the steam are broken up by the first piece of mesh, and this action is continued through each successive layer of mesh until it is so completely atomized upon reaching the outlet chamber, or header, that it flashes into dry steam upon the addition of a small amount of heat, which is obtained by the wire-drawing due to the steam and water passing through the screens. The reduction of pressure is about 1 per cent., and the temperature of the steam is increased proportionately.

The separator is designed so that it can be placed in any type of boiler which is equipped with a manhole of the usual size (11 inches by 15 inches), and is held in position by one or more studs screwed into the shell of the boiler. The connection between the outlet of the separator and boiler outlet is not necessarily steam tight, nor are the joints between the faces of the rings and wire mesh steam tight, as these openings are so small that any steam which leaks through such spaces is slightly wire-drawn with the same result which occurs to the steam passing directly through the mesh of the separator. These small openings on the lower part of the separator also provide the means whereby the entrained water returns to the boiler as it trickles down the successive layers of wire mesh.

Tests recently made by the writer in a 3,000 hp. electric plant with and without the separator are graphically shown in Fig. 3, together with water-level readings taken simultaneously with the calorimeter readings. These readings were taken every minute for five minutes over several hours duration, at ten-minute intervals, and in plotting the curve it will be noted that the average readings for each five minutes were used to give the ordinates.

A Carpenter throttling calorimeter was used, as the readings at no time exceeded 2½ per cent. of moisture.

In this particular case the tests show that the steam issuing from the boilers contained 37½ per cent. more moisture when the separators were not used than was the case when they were used, and this, notwithstanding the fact that the water level in the latter instance averaged materially higher than in the former. Before these separators were installed, this particular plant was frequently troubled with water in the engines, but this difficulty has entirely disappeared; so that, as heretofore stated, the separators prevent the water from leaving the boiler, besides supplying a higher quality of steam.

This test was made on boilers which, as the curve shows, would ordinarily furnish a very fair quality of steam, and the test casts no reflection on the makers of the boilers. If, however, by applying the improvements in "dry pipe" construction, the possibility is assured of keeping the water in the boiler, and at the same time increase materially the quality of

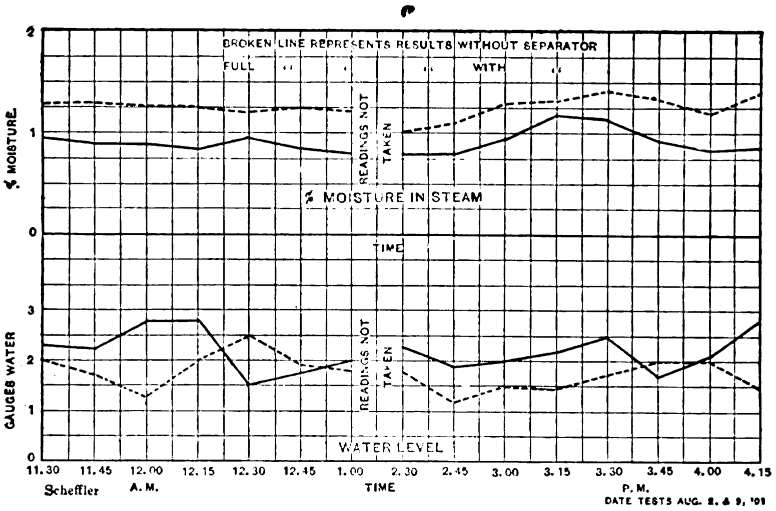

FIG. 3.—TESTS OF POTTER MESH SEPARATOR.

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*Paper read at the meeting of the American Society of Mechanical Engineers held in New York Dec. 3-6, 1901.

the steam at the boiler outlet, then the plant as a whole is improved in efficiency. There will be far less condensation to take care of in such installations between the boilers and the engines, and there will also be eliminated the likelihood of damaged engines, providing the condensation is properly looked after.

WIRELESS TELEGRAPHY IN ITALY.*

It is well known that the Government of Italy, the birth-place of the inventor Marconi, was one of the first to organize official experiments in wireless telegraphy. In fact, it was in July, 1894, that the first experiments in Italy took place, in the first instance at Rome, between two different floors of the offices of the Naval Administration, and afterwards at Spezzia, both trials being under the direction of Marconi himself, who had been expressly invited to come to Italy by the authorities of his country and at the initiative of several of the superior officers of the army and the navy, who even then understood the importance of wireless electric telegraphy and the brillant future in store for it.

Successful results were obtained from these tests; battleships of the Italian navy communicated with the coast of the peninsula at a maximum distance of 16 km., with antennæ of 22 and 34 meters.

Since then experiments in wireless telegraphy have continued uninterruptedly in Italy at the instance of the Ministers of the War Office, and especially of the Naval Administration, to whom Marconi at the time of his experiments at Spezzia had given permission to use his apparatus, and also all the improvements and additions which he might subsequently design for his instruments, which at that time were necessarily primitive. The experiments in question were at first directed by M. Pasqualini, electrician-in-chief to the Navy, and by M. Civita, engineer, and now editor of "L'Elettricita," of Milan. During the first set of experiments, which cost the Italian Government about 100,000 fr., very interesting results were obtained; several battleships were fitted with the apparatus, many stations were established on the Italian coast, and communication was effected at a maximum distance of about 100 km. between a vessel out at sea and a fixed station on the coast.

When Messrs. Pasqualini and Civita retired from the Italian Navy, the wireless telegraphy service was entrusted to the officers themselves, amongst others to Commander Pouchain, now chief of a division in the navy, and to Lieutenant Solari, who recently proposed to the Administration to connect Pekin with the Bay of St. Mun by wireless telegraphy with the aid of several relay stations, or Guarini repeaters..

Then followed some unsuccessful experiments, for instance, between Messina and Reggio, at a distance of a few kilometers; but we also heard of signals reaching English battleships off Malta, having been sent out by Italian battleships off Sicily, the distance between them being about 200 km.

It is certain that the Italian navy has achieved very great progress in the use of wireless telegraphy. In fact, not long ago, the Italian navy succeeded in connecting Sardinia by wireless telegraphy with the mainland, the communication being between Monte Argentan and the Maddalena, thus traversing a distance of 200 km. over the sea.

This brilliant result far surpasses that attained in France, some few months ago, by Marconi himself, with apparatus manufactured by the Wireless Company, between Calvi (Corsica) and Antibes (Provence).

This splendid success is due to the officers of the Italian navy and to the special staff of this important department, who, for four consecutive years, with admirable perseverance and intelligence, have been studying the question of wireless telegraphy, constructing in the arsenals of the kingdom greatly improved apparatus, and carrying out many experiments between the provisional stations established on the higher ground.

The above-mentioned experiments, which have been of great importance to Italy, from both a military and a commercial point of view, were effected without foreign assistance, with very limited funds, granted for the purpose in the budgets; whereas in England, in France, and especially in Germany, scientific men, learned societies, civil and military technical experts, have spent a great deal of money to obtain a result similar to that obtained by the officers of the Italian navy. In a little while a fixed and regular communication between Rome and Sardinia, and the abolition of the submarine cable now in use, will be an accomplished fact. It is proposed to connect Rome with the coast by means of wireless telegraphy, using an automatic relay, but it is almost certain that for the present, at any rate, communication between the capital and the coast will be effected by the ordinary telegraphy.

Before attempting communication with the aid of a relay station the naval department has decided first to try direct communication. The Continental station will be on Monte Mario, in the environs of Rome, the Sardinian station being established on the island of Caprera (on a hill), where rest the remains of Guiseppe Garibaldi.

Besides the wireless telegraph apparatus working on various Italian battleships, there are at present five stations established in the mountain region in very good working order. It is said that in the course of their numerous experiments in wireless telegraphy the Italian officers have made some very interesting discoveries and observations, some of which, particularly some in connection with the antenna and the part it plays in wireless telegraphy, are of a nature to clear up, completely and definitively, things up to the present imperfectly explained, if not completely enveloped in mystery.

It is deeply to be regretted that the Italian Government does not follow the example of other countries, e.g., England, Germany and America, in publishing in extenso the reports of their officers and others appointed to make official experiments.

In the interests of science and for the advantage of all those—and they are numerous—who, in various countries, are working at wireless telegraphy, we hope that the Italian authorities will reconsider their decision and publish the complete results of the experiments in wireless telegraphy conducted by their subordinates, and we urge this the more earnestly in view of the fact that in our opinion it is not a question of safe-guarding military secrets and protecting commercial interests.

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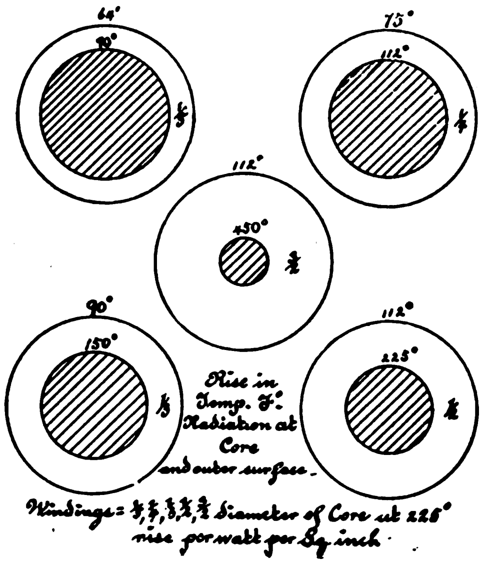
*From the "Electrical Review," London.

PRINCIPLES OF DYNAMO CONSTRUCTION.—VI.

(Written for ELECTRICITY.)

Proportions of Coil Winding.

The graphical representation of the coil proportions advocated in the table appeals more to certain minds than would the written values. The illustration clearly shows the limiting depth which with a certain fixed loss in watts may be increased if desired, though economy would forbid a further use of copper. The situation is merely this: that with a given number of watts dissipated as heat, the greater the volume of copper they raise in temperature the less the specific temperature or heat evolved per square inch of the coil. The sketch above may immediately act as a definite guide to the proper coil design, as follows: Determine the watt loss per square inch at core and outer surface by selecting any proportion on the diagram. By this it is inferred that the C^2R is known; such being the case the dimensions are arrived at by the above system, that is to say, the length of core and depth of winding.


64°
90°
1/3
75°
112°
1/4
112°
450°
1/2
90°
150°
1/5
112°
225°
1/4
Rise in Temp. F.° Radiation at Core and outer surface.
Windings = 1/3, 1/4, 1/8, 1/5, 1/2 Diameter of Core at 225° rise per watt per Sq. inch

The next determination to be made is the size of wire which will have the proper resistance and cross-section for the EMF. and current to be sent into it. This selection necessitates the filling in of the coil space with a certain resistance of copper wire; the ampere turns being known by previous methods. The size of wire may at once be determined from the large table already given, remembering to divide the heat as represented there by the number expressing the ratio between 225° and the heat calculated for on the surface of the coil. If, for instance, the rise of temperature of the coil be 56° the depth of winding given in that table will be 225° with one square inch per watt, but with two or three square inches per watt the temperature will be only one-half or one-third of 225°. The 56° is calculated for on this basis; that is to say, a coil with four square inches per watt for radiation will only rise to 56°, or one-quarter of the heat as given in the table at the depth specified.

The diagram is merely given as an assistance to the designer for the prevention of heavy windings and lack of proportion between core surface and energy dissipated. It also immediately determines the volume of winding with a given C^2R. A formula can be given for the approximate determination of the size of wire when the volume and resistance of the coil is known. But the variable factor will be the percentage to allow for insulation in different sizes of wire, smaller sizes having more depth of covering than the larger in proportion to their circular mils. From 15 to 20 mils extra allowance must be made over the bare wire for sizes ranging from No. 25 to 10 B and S. The formula is then applicable in the following form:

$$D^2 d^2 = \frac{V}{R} \times 960{,}000.$$

D = mils diameter covered.
d = " " bare.
V = volume in cubic inches.
R = resistance in ohms.

In which $D = d + 15$ mils within the sizes above mentioned. As an illustration of its applicability take a coil whose temperature is to be within 75° F. If its diameter of core is eight inches, with winding it will be twelve inches, using the proportions given in the diagram. The length if ten inches will give a volume wire of $10 \times (.8\delta^2 - .8\delta_1^2) = V = 640$ cubic inches.

$$\delta = 12 \text{ inches.}$$
$$\delta_1 = 8 \text{ "}$$

At an EMF. of 100 volts the resistance = 80 ohms and the current 1.26 amperes, then

$$D^2 d^2 = \frac{640}{80} \times 960{,}000$$
$$= 7{,}680{,}000.$$
$$\text{or } D\,d = \sqrt{7{,}680{,}000} = 2{,}771,$$
$$\text{but } D = d + 15,$$
$$\text{therefore } D\,d = d^2 + 15\,d = 2{,}771$$

by the binomial theorem

$$(d + 7\tfrac{1}{2})^2 = d^2 + 15\,d + 56\tfrac{1}{4}$$
$$d + 7\tfrac{1}{2} = \sqrt{2{,}771 - 56\tfrac{1}{4}} = 52,$$
$$\text{therefore } d = 52 - 7.5 = 44\tfrac{1}{2} \text{ mils}$$

or No. 17 B & S gauge.

The heat would be for a coil 3.3 inches deep, 225°, according to the table usually referred to. This would mean a rise of only $\frac{2}{3} \times 225°$ for a winding two inches deep or 150° F.; but this will be still further reduced to one-third by the larger area at the surface of the coil, hence the temperature rise will be $\frac{1}{3} \times 150°$ or 50° F. As the table of coil proportions calls for a 75° rise, a finer wire may be used and less current consumed in the coil; the adjustment being made as suggested by economical considerations. The ampere turns, it being understood, having been found by previous methods, the current is determined by reference to the table of percentages of energy allowed for field coils according to the size of machine in kilowatts. This fact at once fixes the current for the coils if the watts thus allowed be divided by the EMF. to be applied to them. From this we are enabled to calculate the resistance of the coils by the simple rule

$$C \times R = E, \text{ therefore } R = \frac{E}{C}.$$

The coil space or volume of wire, the current, resistance and temperature limit being known, the size of wire is obtained and tested. The heat necessarily affecting its resistance .2 of an ohm each degree Fahrenheit, thus leading to the necessity of a larger wire for very accurate design, otherwise the ampere turns would decrease with the heating of the coils and somewhat weaken the field, though the armature may be more effective in this respect when fully loaded than the coils, because of its lower EMF.

Should coil space be limited, however, the smaller areas will be best as a basis for calculation, though a machine whose design is such that certain parts are cramped and compressed needs but one remedy for an efficient cure, and that is—to redesign it.

ADVANTAGES IN SYSTEMATIC READING OF CURRENT ENGINEERING LITERATURE.[*]

BY PROF. H. WADE HIBBARD.

Among the most valuable members of the engineering profession to-day are the moving spirits of the engineering press. Much matter of great value is regularly to be found in the current periodicals of a profession growing so rapidly and in so many directions as is mechanical engineering. Books, monographs upon particular subjects, necessary as they are by gathering within one cover all the required material of years and many places, and by their orderly classification, logical discussion, and evolving of principles, are, by very necessity of their production, always and inevitably behind the times. The reason for existence of the engineering press is to collect all recent valuable information—news, if you please—and present it weekly or monthly, less or more digested, to as large a circle of readers as possible. The American papers, representing special branches of the profession, far surpass in numbers and variety and excellence the like papers of the old world. Their general use proves that they have a most important place. With these may be grouped the published transactions of the many engineering societies and clubs. Unthinkingly or deliberately to neglect forming an acquaintance with so great a source of engineering knowledge is not fitting for the student who has his own future to make in a country where ruts and old fashions are only for the failures.

Habits are excellent balance wheels, generally. Brilliancy being given but to few men, the great majority must hammer out lesson or problem or engineering feat. In fact, genius has been defined as an infinite capacity to take trouble. Regularity of mind, a habit of undivided intensest application, may place the worker far beyond the one who thinks to accomplish by fits and starts. It is well to form the habit of regular perusal of the weekly "Machinist" or "Engineer:"

Skepticism is the normal state of the scientific mind. It is ever looking for something better, not satisfied that the present is perfect. The reading of articles over the names of famous engineers, afterward to find them severely criticized, is good for the confiding student, who perhaps has supposed that all engineers and professors are agreed. It is just as well for him to learn not to believe all that is in print unless there are good reasons presented.

A good engineering paper should be one of the life partners, ready at hand when movements of leisure permit its instruction and enjoyment, better understood and liked as the years roll on, acquaintance or perhaps friendship formed with editor, contributions made, suggestions given and taken, some share had in its mighty influence in the engineering world.

A union of readers will economize time and enable each to cover more ground and gain greater good. A reading club for discussion, in which each member reads one or two papers and reports upon his leading articles to the rest, is an excellent institution. It has frequently been run with success by the younger men gathered from a railway drafting room, test department, and even including some of the more ambitious young men in the shop. Sometimes a deferred and announced discussion, or an occasionally more formally prepared paper, are useful additions and promote deeper thinking. Such a club adds to the advantage of readers coming into contact with the paper, the decided advantage of more open friction between man and man, a defending of one's position, an acquirement of ability to think while talking, a cultivation of logical placing of thought and word, so necessary for the engineer who must present his ideas to others with force.

Years afterwards, when official responsibilities come, this earlier training will bear good fruit. A superintendent's office will take regularly several papers or several copies of one most useful paper. He marks in these papers appropriate for the instruction or spurring of particular subordinates, and sends them out. Later he will call for meetings of these heads of divisions or departments in his office, and resulting interchange of opinions on the papers, tempered with experience, will prove of decided advantage to the business, promoting unanimity of feeling between the departments and the introduction of the best methods suited for each and perhaps all. The speaker recalls with much pleasure such meetings on the Lehigh Valley Railroad, and has been told only recently by President Vreeland of the Metropolitan Street Railway of New York City, of the success attending his marking of such articles and sending them out, not merely to subordinates, but to some thousands of motormen and gripmen.

DISTRIBUTION OF ELECTRICITY IN CITIES OF MODERATE SIZE.[*]

BY WILLIAM LISPENARD ROBB.

In dealing with the question of the distribution of electricity it is impossible to lay down any but very general principles that will apply to many actual cases. Each individual case will be governed largely by existing local conditions. Much that would be desirable if a plant were being laid out new is found impracticable when the conditions of an existing plant are taken into account.

Cities naturally divide themselves into groups according to population, and for the purposes of this paper I have considered "cities of moderate size" as including those having a population of two hundred thousand or less. A satisfactory solution of the problem of electrical distribution is manifestly different in cities of this class from that in the large metropolitan cities.

Indeed, in dealing with the problem in cities of moderate size, a system of distribution that would be satisfactory for the smaller cities of the class would not meet all the requirements of the larger cities. No exact limitation can be placed as to the point at which the requirements materially change as they are largely governed by local conditions other than population. It seems to me, however, that cities having less than about 50,000 inhabitants make a class by themselves.

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[*] Abstract of an address delivered before the Society of Mechanical Engineers, Sibley College of Mechanical Engineering, Cornell University.

[*] Paper read at the 158th meeting of the American Institute of Electrical Engineers, New York and Chicago, Nov. 22, 1901.

In cities of less than 50,000 inhabitants a very considerable area has to be lighted, in general extending out from two to three miles in all directions from the central station. In a considerable portion of the city electricity will be required only for street lighting. Then fifty to one hundred miles of street will have to be lighted, and arc lighting will generally be required for this service. It will be necessary to supply electricity for incandescent and arc lighting and power whenever desired. In general in the cities of this class there will be practically no tendency to put in isolated plants. There will be found little if any objection to overhead wires. If any wires should be required to be placed underground it will be only in a very limited section of the city, and the total amount of electrical energy supplied from the underground wires would be small. The commercial lighting and power in a city of this class would not be concentrated but scattered over several square miles. The demand for variable speed motors would be too small to be taken into account. The total amount of electrical energy would be too small to warrant the maintenance of more than a single station.

Under all these conditions it seems to me that only three-phase alternating current, having a frequency of 60 cycles and under a pressure of about 2,300 volts, should be generated.

The street arc lighting should be by constant current series inclosed arc lamps. The distribution for lighting would in general be single-phase, and if motors of three hp. or under, only were used, it would be best to operate the motors from the single-phase light system. My own experience has been that single-phase motors above this size are not satisfactory as compared with polyphase motors, and will not meet all the requirements. Any city central station should be capable of supplying power for any purpose, and should be able to supply current for electrolytic and storage battery work. When the motors required are large, then phase motors should be used, and then phase rotary converters installed on the customer's premises should be used for electrolytic purposes. The city should be divided into sections, and the different sections supplied from the different phases. If at any one point in any section large motors or rotary converters are required the additional primary wire would be brought from the nearest point in the adjoining section. Satisfactory service will be given with light and motors supplied from the same circuits.

In sections where there is any concentration of lighting and power a 220 volt three-wire system of secondary wiring should be used, and be supplied if the system is small from a single transformer, or if the system is large, from transformers suitably located at several points. I do not think it would be found desirable in practice to cut out any of these transformers during the hours of light load.

In the larger of the cities of moderate size a different set of conditions exist, and the problem of electric distribution is very materially modified. The area lighted is very large, and while commercial lighting and power is concentrated in sections, lighting and power service has to be supplied in practically all parts of the city. There is a tendency for the department stores, office buildings and large manufacturing industries to put in their own electric plants, and there is a growing demand for the wires in the business section to be put underground.

In cities of this class there are generally two sections where the demand for electricity is concentrated—the business section where are located the large stores and office buildings and the manufactories district. Each of these sections has its own characteristics. In the business district the use of the large motor is largely confined to elevator and other service where the load is exceedingly variable and intermittent, and at the same time the very best lighting service is insisted upon, both as regards the constancy of the lights and the absolute certainty of the service. As a rule in the manufacturing district the percentage variation in load on the motor service is very much less than in the business section, the only variation that seriously affects the lights occurring when the machinery is started in the morning and after the noon hour. At these times there is practically no lighting. While the demand that the wires in the business section should be placed underground must be heeded, there is practically no demand for it in manufacturing districts.

The central station should be located at a point where coal can be delivered directly from the boat or railroad, and where water for condensing can be readily obtained. In nearly all places this means that the generating station will be situated a considerable distance from the business section of the city. The conditions existing in the business section of a city of this class, as against the concentration of load, the intermittent character of the motor load, the necessity and desirability of underground wires, the existing investment of central station and customers in direct current apparatus, isolated plants, and the relatively high price charged at present for alternating currents and arc lamps, motors, etc., make it desirable to supply the business section at the present time with direct current.

Considering that it is desirable to supply both commercial incandescent and arc lighting and also motors from the same system of wiring, it seems best that the current should be distributed on the three-wire 220 volt system. This voltage is preferable to a 440 volt system, as in my opinion in the saving in copper required for the distribution, if the higher voltage is used, is much more than counterbalanced by the inferiority of the 220 volt arc and incandescent lamps as compared with the corresponding 110 volt lamps.

In general, the situation of the power house most suitable for the cheap production of electricity will not be in the business district. The needs of a city of moderate size would also not justify the operation of two power houses. The electricity for the business district should therefore in general be supplied from a rotary converter sub station, situated as nearly as possible to the center of distribution of the business district.

The main power house should generate only alternating current. This should have a frequency of 60 cycles, be a three-phase four-wire system, and have a pressure of approximately 2,300 volts between each phase wire and the common wire. The four-wire three-phase system is preferred, owing to the saving of copper, over other systems that would prevent the using of standard 2-300 volt transformers and other standard line materials. Sixty cycles should be used, as arc lamp motors, incandescent lamps and rotary converters for supplying the 220 volt direct current, can all be operated satisfactorily at this frequency, and at no other frequency at which generators are now made commercially.

The electricity from the power-house to the rotary sub-station should be transmitted on the three-phase wire, the common fourth wire being omitted. Boosters would not be required, and the pressure in the d.c. side of the rotaries would be varied by means of the static transformers used in connection with the rotaries.

The direct current distribution from the sub station should be underground. Not only is this demanded by the public, but in the business section of the cities, I believe that interest of investment cost of maintenance taken into account, it is decidedly cheaper as well as much more satisfactory to maintain an underground than an overhead system of distribution.

The feeders should be lead-covered cables drawn into conduits, as feeders are liable to have for short periods considerable overloads, and there are no branches to be tapped off. I believe paper insulation is more satisfactory as well as cheaper for feeders than rubber.

The distribution boxes should be of the manhole type, or better still, of the lamp post type. The old style of the Edison box blocks traffic too much to be installed at the present time.

When frequent services have to be made there is nothing so satisfactory as the old Edison tubes. When the services are infrequent the most satisfactory system is to use lead-covered rubber insulated cable drawn in ducts as distributing mains, carrying a single service into each building, from a small distributing box placed at every other property line. Arc lighting, incandescent lighting and power should all be supplied from the same system of distribution.

Outside of the busines section the electricity should be supplied for all purposes on the alternating current system. The current should be taken to the power house from various distributing centers on the four-wire three phase system. From these centers of distribution single phase circuits should be run for the operation of commercial arc and incandescent lighting and small motors. Additional phase wires would have to be taken from the centers of distribution to manufacturing plants where large motors were used.

When the lighting is at all concentrated the lighting and motors should be supplied from three-wire 220 volt secondary mains, fed by large transformers, and it will be found desirable to thoroughly ground the neutral wire.

The street lighting should be by series constant current arc lamps. In some cases it would be desirable to supply the current for these from transforming devices located at the central power house. In other cases the transforming devices could be most advantageously located at the centers of alternating current distribution, as thereby the number of wires could be materially reduced, a few large wires taking the place of a very much greater number of small wires.

In order that a system of alternating current distribution of any size should be satisfactory, it is necessary that the arrangement of the power house be such that current be supplied to the different feeders at different pressures. This can be done by boosting transformers in each feeder circuit, and by a system of pressure wires brought back to the power house from the various centers of distribution, or by the automatic device of Mr. W. L. R. Emmet.

The successful introduction of the Nernst lamp into the fields of incandescent and arc lighting, and the development of the steam turbine should have a marked effect in favor of the generating and distribution of alternating current. On the other hand, the air is full of rumors of marked improvements in storage batteries.

REQUIREMENTS OF ELECTRICITY IN MANUFACTURING WORK.*

BY WM. S. ALDRICH.

This paper briefly considers some essential features of electric power transmission in manufacturing work. Earlier treatment of the subject has been varied and somewhat scattered, but not necessarily inadequate as far as the science had been developed at the time of its presentation. The statements and principles here set forth are founded upon what has been done, upon actual experience. Additional and valuable matter will, no doubt be brought out in the discussion of this topic.

Examples illustrating one or more of the principles involved might here be cited in detail, but complete descriptions of installations and valuable results of experience are now accessible on every hand. In fact, the whole development of this field of application of electricity is quite open and above board. It is founded upon common sense and engineering practice. It has therefore at once an advantage over many earlier and some modern or wished for developments of electricity.

The demand for increased production is extending to all lines of manufacturing industry. It is created by the keen competition of trade and the necessity of filling orders promptly. The exigencies of business, therefore, are bringing directly to the front the question of this new motive power in manufacturing.

Factories are not built in a day, but the ready extension of existing electrical supply service has increased the output from 30 to 40 per cent. per square foot of floor space. New machines and tools cannot always be obtained on telegraph order, but a resort to electric driving has increased the output of existing machines from 20 to 60 per cent. Workmen may not be had for the asking, but giving them electric-driven machines has increased the output per man from 10 to 30 per cent. All of this has been developed without any strikes or other than satisfactory regulation of wages by recognized premium and price-rate systems.

It is an axiom that the old established concerns get the business. To day they must guarantee delivery on time and at lower prices to keep their factories and mills in operation. Electric driving accelerates and intensifies production for the first requirement. It reduces the cost of production from 25 to 45 per cent. for the second requirement. Of two manufacturers, each using the same size and style of latest machines, with equally skilled workmen, the one adhering to belt transmission, with its limited capacity and speeds, will probably fall behind in orders. With many manufacturers it is still a question whether the electric drive costs more to install and maintain than the belting system. This can only be determined for each particular case as it arises. If it should cost more, it will still prove a profitable investment when it increases the output per day, per man, per machine, per square foot of floor space, increasing the quantity and enhancing the quality of the product while decreasing the cost. It is no longer a question of the efficiency of electricity vs. shafting for power transmission. Nor is it a question of saving at the coal pile when only 2 or 3 per cent. of the total cost of production is to be charged to the fuel account. In many cases electricity has effected a saving during the first year that has more than paid for the change to the new system. Whether it is more or less economical than mechanical transmission depends upon circumstances. When properly installed and operated, electricity should have inherently all of the considerations in its favor.

The resulting economy of production and the ability to fill orders promptly are all in favor of the electric system. It may be compared to skilled labor—high priced, but very desirable from the standpoint of the economics of production. Few manufacturers still hesitate to employ high priced skilled labor. Many more cling to antiquated methods of driving modern machinery operated by most skillful workmen. To day, therefore, this question assumes very different proportions. The discussion has been shifted to the field of manufacturing economics, involving considerations of maximum output with given equipment, floor space, and working force. It is a question of accepting and filling orders or of losing the business to those manufacturers who can take them.

The disciplinary value of electric driving cannot be ignored. The old easy-going belt system used to allow many a glance at the morning news, many a familiar chat during long and deep cuts. With the electric drive the operator finds it very convenient to be near his machine. The customary warning signals of slipping belts are no longer heard.

Satisfactory illumination should also be provided. No one will work by a smoky torch when he can have an arc or incandescent lamp. Electric light must be supplied in these times in all shops where they make a practice of doing a day's work the year round. Only a little wiring is required, and a small amount of extra power is necessary at the generating plant to drive machines and tools by electricity. In many instances electric lighting has paved the way for electric driving.

We have all had experience in getting men to "speed up" their machines. Tradition and custom are both against the operator who does much belt shifting. In the eyes of almost all journeymen and of some piece workers it is next to treasonable to change the rate of working. Even though paid extra, to do more than a day's work in many shops is still a crime against the union or other combination interested. The workman who attempts it soon finds a job elsewhere or is promoted. The electric drive changes all of this. A press of the button, a turn of the lever, and each piece can be executed at maximum speeds allowed by the temper of the tool speed. It forcibly illustrates Maxim's statement that American workmen find it pays to do as much as they can.

The ever widening applications of electricity in manufacturing work show that it has fully proven its claim to a consideration. It is thoroughly reliable. It has come to stay. It fills the exacting requirements in this new field more economically and satisfactorily than any other system of power transmission. In the common forward movement of industry electricity is still in the van. It stands ready for any emergency within its province, and so far has been equal to each new demand made upon it.

Aside, however, from all purely technical considerations of the application of electricity to manufacturing stands pre-eminently the question: Does it pay? Many manufacturers have conclusively shown that the economies of production have been enhanced by their adoption of electricity; that its inherent advantages in this relation far outweigh all previously debatable questions of economy and efficiency of the electric drive compared with belting transmission, and that even if there were no saving at the coal pile it would still not pay to return to the old method and lose orders.

I.—GENERAL CONSIDERATIONS.

1. Electric Transmission in Manufacturing Work is a Means to an End: Centralized power generation for light and manufacturing purposes; subdivision of the transmission system and the motive power equipment; execution of all classes of work, irrespective of its location; maximum efficiency of workmen, machines, and labor involved; intensified production at best speeds and at the power limit of machines with improved quality, maximum output, and reduced cost.

2. Sanitary Considerations: It is healthful, clean, and free from dirt, dust, and dripping oil; it affords accommodations and facilities for proper lighting and ventilation; it removes dangers from overhead machinery shafting and belts; it reduces the sick list to a minimum; it insures quietness from absence of much unnecessary noise with older systems, and develops cheerfulness among the workmen.

3. Disciplinary Value: It improves the morale and personnel of workmen; it conduces to shop order and discipline, with the most economic use of the workman's time, quick handling of material, and maximum efficiency of labor.

4. Flexibility of the System: Accessibility of all parts, adaptability to various uses, and portability of tools are inherent advantages.

5. Reliability of Service: It is free from any general breakdown, localizing casualities and stopping least machinery for repairs; no accident can affect the whole plant in any case of a modern electrical installation properly designed, equipped, and operated; it is more to be depended upon than any other system.

II. ECONOMICS OF ELECTRICITY IN MANUFACTURING.

1. Electric Power Generation: This system admits of centralized or concentrated power generation which is required for maximum economy. Distributed power generation in small and scattered units is very wasteful.

The electric power plant may be located to best advantage for fuel and water supplies, conveying and transportation facilities. It may be isolated from other structures, so reducing fire risks and insurance rates, especially where the boiler house is in a separate building.

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*Paper presented at the Milwaukee meeting, May, 1901, of the American Society of Mechanical Engineers.

The electric generating sets may be subdivided into similar and independent units. These may be operated at all times under the most economic condition of normal loads. This permits manufacturing work in any branch or section of the establishment as economically under part load as under full load, on overtime and night shifts as during the day's work.

Electric light may be supplied from the power mains or from separate generators, as conditions require. In not a few cases of the introduction of electric driving the additional saving has been more than enough to pay for all of the lighting service.

The cost of generating electric power can only be a deciding factor when the total cost of power required is large compared to the running expense. The saving in fuel depends upon the cost of fuel, the average load, the amount of shafting and belting displaced.

2. Electric Power Transmission: The distances are short in factory service, the electric distribution being within one building or group of buildings. The so-called line losses are therefore usually negligible in well-designed installations. Low voltages are employed in factory transmission. From 110 to 550 volts are the accepted limits at the present time in this country, either for direct or alternating current working at constant potential or pressure. The economics of the various systems can be only satisfactorily discussed with reference to any given project or installation.

The following are recognized methods of distribution, for electric light or power, or both, in manufacturing work:

Two-wire and three-wire systems, for direct or alternating currents.

Multi-circuit system for direct-current multi-voltage service.

Single-phase, two-wire alternating current.

Two-phase three-or-four-wire alternating current.

Three-phase, three-or-four-wire alternating current.

Composite system, direct-current and single-phase or two-phase alternating current on the same wires.

3. The First Cost of Electrical Installation: This will usually be higher for an electrical than for a mechanical transmission. The interest on first cost will rarely be a determining factor. It will be more than offset by the manufacturing economies elsewhere effected and by the reduced cost of shop buildings incident to the use of the electric drive.

4. Maintenance of Electric System: The cost of maintenance is a minimum. The depreciation is less than in any other system.

The saving effected is much more than sufficient to pay for all of the incidental repairs and renewals to the electrical machinery or the wiring system.

Attendance and supervision are largely centralized and reduced to a minimum compatible with efficient service, owing to the reliability of the system.

Electric generators and motors are the simplest types of motive power machinery that can be used in the development of power transmission for manufacturing work. They have the fewest parts requiring any renewals. They require practically no repairs.

Electric machines will either work or not work. They soon make their wants known. They cannot be maintained in wasteful operation, as is the case with every other kind of motive-power machinery. Standardization of this class of electrical machinery has facilitated repairs. They are quickly and easily made, at minimum cost with least interference with the routine work of the establishment. Small electric motors in general require more frequent attention and renewals than larger machines.

Belt tightening or lacing in the old system stops work on that section, and stops all work if it chances to be a main driving belt. Any similar casualty in the electric system is remedied at once by throwing into service another line, or a jumper, or a relay bus-bar.

III. INFLUENCE OF ELECTRIC TRANSMISSION UPON FACTORY BUILDINGS.

The design, plan, and arrangement of manufacturing establishments are not now dictated or controlled by the new electric transmission, as always has been the case with the old mechanical system. Factory and mill construction is undergoing radical changes incident to the electric transmission of power. There is now a superior adaptation of the building to manufacturing work and sanitary requirements, with higher ceilings for light, ventilation, and overhead transportation. The cost of buildings is reduced to a minimum. The electric drive does not require the heavy construction of walls, overhead work, and roof trusses demanded by shafting transmission.

The site for buildings may be chosen independent of power considerations and located on most suitable ground. There is no necessity for buildings being placed around or adjacent to the power house, as required for mechanical connections to engines or turbines. Grouped shops may be arranged in best manner to facilitate economic production and the handling, conveying, and transportation of material and work. Detached buildings—a tendency of certain lines of modern manufacturing development—are feasible, and the work therein facilitated by electric transmission. The isolation of various shops, departments, and workrooms for manufacturing or insurance reasons may be carried to any extent with the electric system without impairing its efficiency or economy. The output per square foot of floor space is a maximum with electric transmission.

IV. INFLUENCE OF ELECTRIC TRANSMISSION UPON WORKSHOP EXPANSION.

Future areas of work may be planned and arranged for with the utmost freedom and entirely irrespective of power considerations. They can be located as desired, on separate floors, in various departments, or in detached buildings. Original provision for prospective development is not necessary in the electric system, but is required by shafting transmission. There is no expense for contemplated additions till they are actually installed as required.

Permanent additions to the electric generating plant and the distributing system are made with a gradual and pro rata outlay of capital, instead of in disproportionate blocks of new equipment, as required by mechanical transmission.

Extensions of electric transmission and new centers of power distribution may be established at any time and of reasonable capacity, anywhere and at any distance, at minimum cost for labor and material. There is no crowding, overloading, or interference with existing conditions, or with the daily progress of routine work. Temporary extensions, to meet sudden demands for power at any point, are quickly made by running to the desired location electric wires or cables. These are easily removed when no longer required and as readily used elsewhere for similar purposes. The shifts are made with the least expense of time and labor in handling, and with no accompanying waste of material to suit different conditions.

Auxiliary power is always at hand for emergencies and to almost any reasonable extent, on account of the reserve nature of the electric supply.

V. INFLUENCE OF ELECTRIC DRIVE UPON ARRANGEMENT OF MACHINERY.

The floor space required per machine or tool is reduced to a minimum.

The alignment of overhead shafting is no longer necessary.

Clear overhead room is provided for handling all classes of heavy work. The crowding and complications arising from overhead shafts and belts are avoided.

Location of machines and tools may be made to suit the requirements of the work and the available floor space. The product may then be finished with least time and labor, with least handling and transportation, and in the most efficient and economic manner.

All the conditions of work and of labor may be arranged to handle tools and material to the best advantage with freedom of workmen's movements and facilitate in executing manufacturing operations.

VI. CHANGING FROM THE OLD TO THE NEW SYSTEM OF DRIVING.

When alterations or additions in power transmission are required, it is the invariable practice in many modern shops to extend in the line of electric driving. This is notably the rule where electric supply is already at hand for either lighting or power service. In the rehabilitation of an old establishment some of the shafting transmission may usually be combined with the electric drive, as in the so-called group system. Much can be done to improve the power transmission if existing lines of shafting are divided into the most economic sectional lengths, determined by the speed, character of load, and kind of work. Electric motors will prove valuable adjuncts if installed to drive these sections independently. The electric drive is an economic and flexible auxiliary, supplementing the earlier and rigid mechanical power transmission. Such partial introduction of the new system, especially if an electric lighting plant is already in service, will early develop its advantages. It will defray the cost of installation and maintenance by greater economic production.

Scrapping the old to make room for the new involves the same economic questions in the case of power transmission as in that of manufacturing machinery. Productive machinery should not in general be scrapped while there is retained the old system of belt driving, with its inherent power and speed limitations. The increased output of the old machine, electrically driven, will frequently equal that of a new machine, belt driven, and turning out the same kind of product.

(To be continued).

Denial from the Storage Battery Company.

The Electric Storage Battery Company on Saturday filed in the Court of Chancery at Trenton, N. J., its answer to the bill of complaint filed some time ago by Richard Siegman against the Electric Storage Battery Company and the Electric Vehicle Company. The answer makes a complete denial of all the charges contained in the bill of complaint.

The main charge in the bill was that the Storage Battery Company, through its directors, some of whom were also directors in the Electric Vehicle Company, had diverted a large part of the stock of the Vehicle Company into the treasury of the Storage Battery Company without adequate compensation.

The Storage Battery Company claims that the stock of the Electric Vehicle Company was obtained through proper business transactions, and that adequate compensation was given for the same. It is claimed that part of the stock of the Electric Vehicle Company, 19,000 shares, was obtained by the Storage Battery Company by the payment of $1,940,000, its par value, and another block of stock, 48,000 shares, by the transfer to the Vehicle Company of the controlling interest which the Storage Battery Company held in the Columbia Automobile Company.

It is further claimed that the transactions were conducted openly at meetings of the stockholders of the Vehicle Company, and that Mr. Siegman offered no objections at the time.

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Electric Power for Naval Vessels.

The Board of Naval Construction, in a report to Congress, states it is of the opinion that wherever the military efficiency of naval vessels can be increased by the use of electric power for auxiliary machinery it should be done, and also, as a large electric plant must of necessity be installed for military purposes, such as lighting, searchlights, turret-turning gear, ammunition hoists, rammers and elevating gear for heavy guns, etc., the use of electric power can with propriety be applied to other auxiliaries not likely to be used in action, but which the electric plant is capable of operating when the vessel is not engaged in battle—such as boat cranes, deck winches, etc. The board is also of the opinion that great attention should be given to the type and size of the electric generators, their installation, and the installation of electric conductors; to the means of interior communication, and all other essential features.

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New York Electrical Society.

The 219th meeting of the Society will be held at the College of the City of New York, corner of Lexington avenue and 23d street, Thursday, December 19, at 8 P.M. Professor Dayton C. Miller, of the Case School of Applied Science, Cleveland, O., will deliver a lecture on "Polarized Light." Synopsis: The ether and the wave theory of light; interference and refraction; color dispersion and the spectrum; nature of polarized light; production and detection of polarized light by the Nicol prism; color phenomena of thin plates of doubly refracting substances; complementary colors; rings and brushes of color produced by crystals; applications of polarized light; beautiful color effects of circularly polarized light. The lecture will be illustrated by means of a large projection polariscope, with many rare specimens, and by models and other subsidiary apparatus. Brilliant contrasts of complementary colors in many combinations will constitute color phenomena of unusual beauty.

The following members were elected at the last meeting of the Society: Walter A. Houghtaling, Leonard T. Horner, E. J. Wehrley, T. P. McCray, J. Roberts Wilson, Lyman P. Hammond, F. S. Blackall, H. W. Olin, G. A. Callanen, W. L. Conwell, Frank Clark Cosby, W. S. Rugg, George Wacker, Charles E. Monroe, Lloyd Reed, Frank Mauro and A. T. Jenks.

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PERSONAL MENTION.

Mr. Morris W. Mead has been reappointed chief of the electrical bureau of Pittsburg, Pa.

Mr. Frank Moffat, of Dallas, Tex., has been appointed city electrician of Manila, Philippine Islands.

Mr. Lemuel Bannister, for the last five years general manager of the British Westinghouse Company, has resigned his positions in all the Westinghouse companies.

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INCORPORATIONS.

The Power Equipment Company, Trenton, N. J. Capital stock, $6,500,000.

The Electric Specialty Company, Kennett Square, Pa. Capital stock, $25,000.

The Electric Motor Specialty Company, New York City. Capital stock, $20,000. Directors: H. O. Swoboda, of New York City, and J. T. Beswick and David Beswick, of Brooklyn.

The Union Electric Light & Power Company, Logan, Utah. Capital stock, $40,000. Shareholders: J. F. Wright, Joseph Howell, Martha Wright, W. C. Parkinson, G. F. Wright and E. R. Owen.

The Grinnell Electric Cable Construction & Apparatus Company, New York City. Capital stock, $250,000. Directors: H. B. Grinnell, O. A. Doering and F. E. Thompson, of New York City.

The United States Electric Supply Company, Detroit, Mich. Capital stock, $50,000. Shareholders: Arthur G. and Henry Holland and A. E. McKinnon, trustee, of Detroit, and E. L. O'Connell, of Dayton, O.

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ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DEC. 10, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

688,337. Means for Electrically Connecting Railway-Cars. Emil B. W. Reichel, Berlin, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Feb. 19, 1900.

688,346. Trolley-Pole for Electric Cars. Philipp Scholtes, Mount Oliver, Pa. Filed Sept. 16, 1901.

688,456. Electromechanical Automatic Street-Railway Switch. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, same place. Filed July 2, 1901.

688,486. Trolley Contact Pole, Ernest B. Robertson, Philadelphia, Pa., and Samuel N. Dole, Camden, N. J. Filed July 12, 1901.

688,509. Trolley. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel Company. Filed Dec. 1, 1899.

688,568. Trolley. Milford J. Wilson, Painesville, O. Filed Aug. 12, 1901.

688,572. Electric Railway. Frank M. Ashley, Brooklyn, N. Y., assignor to the General Electric Company of New York. Filed Feb. 26, 1898.

688,629. Trolley-Wheel Guard. Edward W. Gailey, Allegheny, Pa. Filed May 13, 1901.

688,724. Electric Signaling Device for Railways. William A. Farrell, Wellsville, N.Y., assignor of one-half to Jacob Rauber, same place. Filed April 1, 1901.

688,745. Automatic Safety Gear and Signal System. William W. Murch, Brooklyn, N. Y., assignor of one-half to John R. Parker, same place. Filed March 9, 1901.

688,797. Electric Railway-Switch. Philip Siegel, New York City, assigor to himself, Joseph Liebman and Bernard Karneol, same place. Filed June 13, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

688,435. Mast-Arm for Incandescent Street-Lights. Ralph J. Patterson, Woburn, Mass., assignor of two-thirds to L. R. Wallis, Winchester, Mass., and W. H. Bolewine, Woburn, Mass. Filed March 14, 1901.

688,486. Electric Lamp and Socket Therefor. Daniel D. Nugent, Harrison, N. J. Filed Jan. 4, 1901.

688,575. Electric-Arc Lamp. Henry Baggett, Blackheath, Eng. Filed Sept. 13, 1899.

688,649. Electric-Arc Lamp. Charles H. Kayser, Orange N. J., assignor to the Edison Manufacturing Company, same place. Filed March 5, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

688,282. Electric Switch. Carl A. Bergstrom, New York City, assignor of one-half to Martin Singer, same place. Filed July 21, 1900.

688,317-688,318. Winding for Electric Machines. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company. Filed April 17, 1901, April 30, 1901.

688,340. Direct-Current Dynamo-Electric Machine. August Rotth, Berlin, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed May 19, 1900.

688,359. Circuit-Breaking Apparatus for Electrical Circuits. Lewis B. Stillwell, Niagara Falls, N. Y., assignor to the Westinghouse Electric & Manufacturing Company. Filed June 12, 1900.

688,382. Mechanism for Transmitting Power to Dynamo Machines. Otto Bohm, Oberschonweide, near Berlin, Germany. Filed Aug. 22, 1901.

688,423. Commutator-Brush Holder. Harry J. W. Lloyd, Des Moines, Iowa. Filed Feb. 11, 1901.

688,504. Electrical-Controller Attachment. Guy L. Fairbrother, Thompsonville, Conn. Filed April 19, 1901.

688,554. Circuit Making and Breaking Device. John F. Skirrow, East Orange, N. J. Filed Feb. 4, 1901.

688,583. Electric Knife Switch. William F. Bossert, Utica, N. Y. Filed May 20, 1901.

688,614. Regulator. Augustine R Everest, Lynn, Mass., assinor to the General Electric Company of New York. Filed May 4, 1899.

688,616. Rotary Pump or Motor. Allen Ferguson, 1,000 Springs, Idaho, assignor of three-fourths to Benjamin G. Mullins, Bliss, Idaho. Filed Oct. 9, 1900.

688,650. Apparatus for Measuring Electrical Energy. Rankin Kennedy, Leeds, Eng. Filed Feb. 21, 1901.

688,670. Magnetic Friction-Brake. John McGeorge, Cleveland, O., assignor to the Electric Controller & Supply Company, same place. Filed May 9, 1901.

688,738. Electric Switch. James Jones and James Jones, Jr., New York City, Filed Nov. 6, 1900.

688,805. Alternating-Current Motor. Ernest Wilson, County of Kent, Eng. Filed Jan. 17, 1893.

TELEPHONES AND TELEPHONE APPARATUS.

688,433. Telephone-Receiver. Francis J. Orr, Holland, N. Y. Filed Jan. 12, 1901.

688,452. Telephone-Exchange System. Harry G. Webster, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, same place. Filed Dec. 31, 1900.

688,673. Telephone System. Charles H. North, Cleveland, O., assignor to the North Electric Company, same place. Filed May 17, 1900.

688,676. Telephone. William S. Paca, Baltimore, Md. Filed Jan. 20, 1897.

MISCELLANEOUS.

688,291. Electric Storage Battery or Accumulator. William J. Buckley, Chicago, Ill. Filed Sept 1, 1900.

688,293. Telephony. George A. Cardwell, New York City. Filed Nov. 16, 1899. Renewed May 10, 1901.

688,364. Electric Furnace. Edward R. Taylor, Penn Yan, N. Y. Filed Dec. 21, 1899. Renewed April 18, 1901.

688,393. Electric Furnace. Ramon C. Contardo, Sevres, France. Filed March 22, 1901.

688,394. System of Electrical Distribution. John L. Creveling, New York City. Filed Dec. 7, 1900.

688,401. Electrical Apparatus, John E. Everett, Indianapolis, Ind., assignor of three-fourths to Frank H. Blackledge, Albert S. Blackledge, and John W. Blackledge, same place. Filed Feb. 21, 1901.

688,403. Electric Battery. George W. Frazier, Allegheny, Pa., assignor of one-half to William McB. Bell and Samuel M. Evans. Filed Feb. 14, 1901.

688,458. Stereoscopic X-Ray Apparatus. Eugene W. Caldwell, New York City. Filed Sept. 27, 1901.

688,494. Thermo-Electrodynamic Transformer. Philip K. Stern, New York City. Filed Feb. 15, 1901.

688,624. Insulating Material. Max Frank, Strasburg, Germany, assignor to Emil Frank, New York City. Filed Sept. 15, 1899.

688,749. Storage Battery Tray or Case. Elmer A. Sperry, Cleveland, O., assignor, by mesne assignments, to National Battery Company. Original application filed Sept. 18, 1899. Divided and this application filed Nov. 6, 1899,

688,783. Recording Device. John D. Keiley, New York City. Filed July 17, 1900.

688,788. Primary Battery. Henry I. Lurye, New York City, assignor of one-half to Nathaniel H. Lewis, same place. Filed Jan. 30, 1901.

DESIGN.

35,424. Feeder-Arm for Poles of Electric Railways. William A. McCallum, Cincinnati, O. Filed Nov. 1, 1901. Term of patent 14 years.

THE TELEPHONE WORLD.

Telephone Combination.

According to trustworthy information, says a dispatch from Chicago, the battle which for a long period has raged between the Erie Telegraph & Telephone Company and the Bell Telephone Company, for control of the country's telephone business has reached its climax. It is reported in local financial circles that the Bell people have succeeded in absorbing the Erie system.

The Erie Telegraph & Telephone Company has a capital stock of $10,000,000 and bonds aggregating $17,500,000. It owns a controlling interest in the Cleveland Telephone Company of Ohio, the Northwestern Telephone Company of Minnesota, the Southwestern Telegraph & Telephone Company of New York, the Michigan Telephone Company of Michigan, and the Wisconsin Telephone Company, the aggregate of whose capital reaches $24,000,000.

It is said that the buying of Erie stock for the Bell Company was done by agents in different parts of the country, who worked with great secrecy.

The New York Telephone Company has made an innovation in the shape of a "four-party line service" subscription to which for 500 messages a year costs $48. This rate is for the resident telephone service of the Borough of Manhattan. Contractors for a "one party," or direct line receive a rate of $66 a year, instead of $75, the former price. "By a four-party line," said F. H. Bethel, contract agent of the New York Telephone Company, "is meant that there are four telephones on one circuit. By reducing the number of wires we are able to lower rates. There are many householders who do not make over 500 calls in a year, and to them this new rate will prove attractive. Generally speaking, New Yorkers do not want many stations on one circuit. In other cities as many as ten persons contract for the use of one circuit. By doing that they obtain a rate of about $24 a year for their telephone service. But in New York no one wants to run the risk of waiting until nine others have had their turn at the receiver. There are 70,000 stations in this borough. The greater part of these direct lines rent for $5.50 a month, or $66 a year.

A report from Uniontown, Pa., states that the entire coke region is anxiously watching the fight being made by two patrons of the Central District Telephone Company to compel the company to acquire part payment of the rentals of their telephones as an offset to the alleged unsatisfactory service they have been given. Recently the matter came before the county courts and an injunction was obtained restraining the telephone people from removing the telephones until the controversy is settled. The patrons in the contest are the Title & Trust Company of Connellsville, and Attorney E. C. Higbee.

The workmen of the Delaware & Atlantic Telephone & Telegraph Company at Wilmington, Del., are busy. A large force of men are at work installing new telephones, and Manager Mehaffey says that, although he has an extra force employed, the demand for telephones is so great that they cannot be installed as fast as the company desires. At present the company has nearly 1,700 telephones in service in that city. The company will also string several cables on the outskirts of the city.

A company has been organized by the business men of Long Pine, Neb, and the ranchmen in the southern part of Rock County to build a telephone line from that place to the "A D," cattle ranch, via Selden, Spragg and Butler. The line will be between 31 and 32 miles in length. The following are the officers of the company: President, M. D. James, of Spragg; vice-president; O. J. Johnson, of Spragg: treasurer, J. Boerger, of Spragg; secretary, W. A. Benklin, of Long Pine. The company will be incorporated.

Assemblyman William Schneider proposes to introduce in the Legislature a bill regulating telephone charges in Buffalo, N. Y. Mr. Schneider's bill will fix the yearly rate for unlimited business service at $40, and for telephones in residences at $20 a year.

The new Automatic Electric Company, recently incorporated in Springfield, Ill., to introduce the Strowger instrument, which is operated without "hello" girls and permits secrecy in conversation over the telephone, will begin business with an order from the Illinois Telephone & Telegraph Company for a switchboard and its appliances and devices for 25,000 telephones.

The stock of the Pike County, Miss., Telephone Company has changed hands and the lines will be extended and the service generally improved.

The Illinois Independent Telephone Company has been granted a 20-year franchise in Moline.

Independent Telephone Men Organize.

The representatives of 20 independent telephone companies of Central Missouri have lately held a convention at Sedalia, with F. A. Churchill of St. Louis, as presiding officer. The object of the meeting was to organize an independent line association for mutual protection and to discuss ways and means of establishing a long-distance independent line.

The Citizens' Telephone Company of McMinnville, Tenn., organized to fight the rates proposed there by the Cumberland Telephone Company, recently effected an organization by the election of the following board of directors: A. R. Hammer, M. L. Fletcher, R. M. Reams, A. H. Faulkner, W. J. Rice, Clay Faulkner, W. H. Ross, J. I. Finney, Jesse Walling, president, and W. S. Lively, general manager. The full amount of stock will be subscribed and more than 108 of the subscribers to the Cumberland Company have signed a pledge that they will use no line but the local company.

A telephone exchange of probably 50 'phones will be installed at Gowrie, Ia. This franchise was granted to Robert L. Parker at a meeting of the city council, and work on the new system will be commenced immediately. Several rural lines are being planned, and the indications are that Gowrie will soon be the center of an extensive telephone system.

The Independent Long Distance Telephone & Telegraph Company of Louisville, Ky., has been granted a permit by the fiscal court to construct its lines along the highways of Shelby County. The company is now building a line between Louisville and Lexington, and will traverse Shelby County, the route being the State pike. The work will shortly be commenced in Louisville.

The Independent Telephone Company is now putting in the 'phones in the business houses and residence buildings of Hutchinson, Kan. It has secured a large number of subscribers, and is about ready to begin business. Mr. Burns said recently that while the time of completing the work depends somewhat on the weather, there is every prospect of having the new 'phones working by the 20th of the present month.

The long distance telephone system which has been talked about so long is now being put up at Courtland, Ala. The local telephone exchange for that place will also be put in as soon as the poles can be put up and the wires stretched. This will be of incalculable value to the business men to say nothing of the value of the long-distance telephone to the public generally.

The Cincinnati & Suburban Telephone Company will shortly install a telephone exchange at Norwood, O. This step is taken because the business of the telephone company at that suburb has grown at a remarkable rate since the rent for service has been reduced. The new exchange, when installed, will serve people within a radius of two miles.

News from Scottsboro, Ala., states that the citizens of Paint Rock Valley are building a co-operative telephone line up the valley from Paint Rock station. This will be of great value to them, as they are cut off from outside communication for several miles.

The Wilcox conduit promoters of Chattanooga, Tenn., have formally organized a company, styled the City Telephone Company. The following officers were elected: President, M. T. Freeman; secretary, T. H. Lasley; treasurer, J. W. Johnson.

H. R. Head is building a local telephone line at Grand View, Tex., and it will be completed in 60 days. He will have connection with long distance telephones, and also have charge of the long-distance telephone office at that place about the first of January.

An extended system of telephones is soon to be had in Deer Lodge, Mont. Linemen in the employ of the Rocky Mountain Bell Telephone Company have been busy stringing wires and preparing to install the new 'phones.

The North Wales, Pa., council has granted the United Telephone Company an ordinance to erect a telephone line in that borough.

On January 1 the Southern New England Telephone Company will open three new exchanges in Connecticut at Pomfret, Putnam and Enfield.

Paoli and Marengo, Ind., are now connected by a telephone line just completed by the Orange County Telephone Company.

Nickel-in-the-Slot Telephones for Chicago.

Telephoning in Chicago is becoming a nickel-in-the-slot habit. Thousands of these instruments have been installed. Movable telephones are being installed in leading restaurants, with plugs beside every table, enabling customers to use the apparatus while eating their meals.

"Six months ago Chicago had 30,000 telephones. To day she has 40,000, and within the next two years we will install instruments that will bring the total number of subscribers up to 100,000." This is the way John I. Sabin, president of the Chicago Telephone Company, tells the story of the enormous increase in the number of telephone subscribers. The demand he says, is beyond the resources of the corporation. The directors lately decided to issue $3,000,000 additional stock in the coming year, making a total increase in 12 months of $5,000,000.

Several thousand applications for the service are now in the hands of the installation department, every branch of the working force has been increased more than 20 per cent., and all canvassers have been taken out of the field.

One interesting feature has been the opening of what is practically a school for new operators, who are given places at switchboards as soon as they pass the tests required.

Of the 10,000 new subscribers secured during the last six months 9,000 are persons who have never before used the telephone. The firms that have always been large users are demanding the installation of individual switchboards and internal service, a system that within the last few weeks has been obtained by several hotels.

The Cumberland Telephone Company has completed telephone connections with a colony of lepers near Donaldsonville, La. The colony is the only one of its kind in the the United States, and, of course, the exchange is the only one of its kind. The lepers are diligently quarantined, and are as completely isolated and outcast as it is possible to be in this country. The telephone connection is probably the greatest god-send that could come to them, as it puts them in touch with the outside world and gives them the longed-for opportunity of conversing with relatives and friends.

A company of Kenton, O., men organized the Kenton Construction Company a short time ago. The purpose of the company is to build telephone exchanges, and the first one of these will be at Orange, Tex. The company has a capital of $50,000, and unlimited resources. A similar company was organized at Ada some time ago, and it has built an exchange at Beaumont, Texas, ten miles from Orange.

The Black River Telephone Company having headquarters in Boonville, N. Y., is planning to make an application in Utica for a franchise. The company has a capitalization of $25,000, with H. C. Markham of Lyon's Falls as president.

The Howard, Ill., Telephone Company is enjoying unusual prosperity. At a meeting of the directors a dividend of 50 per cent. was declared, and there is still considerable money left in the treasury.

Owing to the fierce gales and snow storms that swept over Great Britain on December 12 and 18, the postal authorities report the worst break down of the telegraph and telephone system that has occurred for 20 years.

The Automatic switchboard has been installed and used for several years at Augusta, Ga.; Princeton, N. J.; Geneva, Ithaca and Perry, N. Y.; Albert Lea, Minn.; Trinidad, N. M.; New Bedford and Fall River, Mass.

TELEPHONE INCORPORATIONS.

The Farmers' Mutual Telephone Company of Cohoes County, Mattoon, Ill. Capital stock, $10,000. Incorporators: J. F. Miller, J. F. Brewster and A. G. Hildreth.

The Gasconade Telephone Company, Bay, Mo. Capital stock, $12,000. Incorporators: E. T. Williams, W. F. Langenberg, Peter Denuser and others.

The Northwest Texas Telephone Company of Graham, Tex. Capital stock, $4,500. Incorporators: R. G. Graham, W. L. Donnell, J. H. Ball and others.

The Home Enterprise Telephone Company of Woodward, Okla. Capital stock, $10,000. Incorporators, C. R. Alexander, E. S. Wiggins, George H. Brophy, E. B. Roll, B. W. Key, F. D. Healy and L. B. Collins of Woodward.

The Jones County Telephone Company, Des Moines, Ia. Capital stock, $50,000. President, L. H. Camp; vice-president, L. M. Middleton; secretary, C. H. Brown; treasurer, H. F. Camp.

The Utica Home Telephone Company, Utica, N. Y. Capital stock, $200,000. Directors: C. H. Poole, H. F. Miller and E. B. Odell of Utica.

GENERAL ELECTRICAL NEWS.

Lighting.

Bessemer, Ala.—The electric lighting plant here bought by the Birmingham Railway, Light & Power Company, will be improved and enlarged. The sum of $250,000 will be spent in making the extensions.

Binghamton, N. Y.—The Broome County Electric Company is preparing to install a plant here to provide commercial lights for the city, and to light the streets with arc lights.

Concordia, Kan.—T. J. McCue has bought the interest of W. M. Peck and the Cloud County Bank in the Concordia Electric Light Company.

Danville, Ky.- Geo. F. Anderson and others, who incorporated the Danville Electric Power & Railway Company, with a capital stock of $100,000, have secured lighting franchises.

Dyersburg, Tenn.—This city will vote January 2 on the issuance of $50,000 of bonds for buying and improving the present system of waterworks and lights. The mayor can give further information in relation to same.

Estelline, S. D.—It is now an assured fact that this place will soon be lighted by an electric light plant. R. M. Parsons, a local capitalist, has made a canvass of the town, and has decided to establish the system.

Gloster, Miss.—The Bank of Gloster has purchased $23,000 electric light and water bonds.

Huntsville, Ala.—The city council has directed the committee on lights to investigate the feasibility of establishing an electric light plant so that the city may have its own light service.

Iron Mountain, Mich.—This city will probably have a municipal electric light plant.

Jennings, La.—A petition will be placed before the town council asking that an election be ordered allowing the citizens to vote upon the question of sewerage, electric lights and waterworks.

La Salle, N. Y.—This place is to have electric light from Niagara Falls, a contract having been signed with the Falls Power Company to that effect.

Livingston, Mont.—The city council has granted a 10 year franchise to A. O. Newton, giving him the right to erect poles in the alleys of the city, and to string wires to conduct electricity for lighting purposes.

New Berne, N. C.—This city will now put in an electric plant of its own, both arc and incandescent lights.

Ogdensburg, N. Y.—The question of municipal ownership of an electric lighting plant is being vigorously agitated. The feasibility of generating sufficient power from the pumping plant at the waterworks is being investigated.

Orange, Va.—The town authorities are negotiating for an electric light plant.

Peoria, Ill.—The city council has adopted a resolution for the appointment of a committee to devise ways and means for the erection of a municipal electric light plant.

Pocomoke City, Md.—Dr. W. H. Walters has purchased of Hon. Lloyd Wilkinson the electric light plant, and will take charge January 1.

Poughkeepsie, N. Y.—The Poughkeepsie Light, Heat & Power Company, proposes to enlarge its electric plant at the foot of Mill street.

Sterling, Ill.—The Sterling Gas & Electric Light Company was granted a franchise for the ensuing 25 years.

Waukegan, Ill.—The Milwaukee capitalists, who own the Waukegan Electric Light Company, who have had a monopoly on electrical service here for the last eleven years, are now to have competition, and lower prices are looked for. Local parties are organizing a new company, to be stocked for $100,000, and will have for manager M. Hussey, formerly manager for the old company.

Street Railways.

Akron, O.—The latest rumor is that the Cleveland, Terminal & Valley Railroad is to be equipped with electricity. This will be for passenger business only.

Batesville, Ind.—The Batesville, Ripley County Traction Company, capitalized at $10,000, will build a street railway in Greensburg, and an interurban line from Shelbyville, through Greensburg to this place. The stockholders are Louis Zollier, Sherman P. Minear, Charles R. Porter, William N. Harding, Thomas E. Goodrich, Enos Porter, Albert DePrey, John R. Messick and Emery R. Minear.

Belton, Tex.—J. M. Carter, manager of the electric railway company which has secured a franchise for the proposed road between here and Temple, states that work will be pushed on the same. Mr. Carter can be addressed at 294 Exposition avenue, Dallas, Tex.

Berwick, Pa.—After a fight of months the borough council has granted the Columbia & Montour Electric Railroad the right of way through the streets of the borough, allowing them to use a "T" rail.

Buford, Ga.—M. S. Garner, one of the promoters of the Cummings & Buford Railroad, states that the projectors have secured a charter for an electric line.

Chattanooga, Tenn.—Negotiations have been practically completed for the sale of the Chattanooga City Electric Railway Company's lines to the Rapid Transit Company controlled by the United Light & Power Company.

Elmira, N. Y.—The route for the proposed electric railway, which will connect this city with Waverly, is being surveyed.

Gouverneur, N. Y.—Charles A. Lux of Clyde and Samuel P. Nichols of Palmyra have been here lately looking up the feasibility of an electric road to connect this place with Edwards, Fowler and other places.

Hamilton, O.—The Hamilton & Lindenwald Electric Transit Company, which has recently been acquired by the Pomeroy-Mandelbaum syndicate, has increased its capital stock from $100,000 to $250,000. The road will shortly be consolidated with the Southern Ohio Traction Company.

Johnson City, Tenn.—It is reported that parties from Knoxville are interested in a plan to build an electric street railroad in the town and suburbs.

Kenton, O.—The county commissioners have granted to the Tiffin & Southwestern Electric Railway Company a franchise to run from Marseilles to this city.

La Salle, Ill.—W. V. Coons will petition the Ottawa council for a franchise for the Interurban Electric Railway.

Long Beach, Cal.—The ordinance granting a franchise for the operation of an electric road in certain streets to Epes Randolph was lately passed.

Mechanicsville, Vt.—A scheme is under discussion to build an electric road from here to Granville, and thus connect with the road to Whitehall.

New Brunswick, N.J.—The Pennsylvania Railroad is reported to be behind the incorporation of the Trenton & New Brunswick Railway Company at Trenton. The company is organized under the General Railroad act, with a capital stock of $1,000,000. The road is to be 23 miles in length, and to run from a point in the Borough of Milltown to a point in the Township of Hamilton, in Mercer County, near the eastern boundary of the city of Trenton.

Orland, Ind.—J. H. Roberts of Grand Rapids, Mich., was recently here agitating the construction of an electric line from this place to Bronson, Mich.

Silver City, N. M.—The city council has granted a franchise to L. P. Deming, Lucius Deming, T. W. Carter, of New Haven, Conn., and M. W. Porterfield of Silver City, permitting them to build a line of electric railway connecting the mining camps of Santa Rita, Fierro, Hanover, Central, Pinos Altos and the Burro Mountains with this city.

Toledo, O.—The Ohio & Michigan Air Line Railroad Company, incorporated with $1,000 capital stock, plans to build one of the links in the Everett-Moore system. The company will construct a line from this city, where the principal office is to be, to Monroe, Mich., to connect with the syndicate's road running in to Detroit. The incorporators, all Cleveland men, are Robert Crasser, S. M. Hildreth, H. B. McGraw, H. B. Potter, and A. A. McCasslin.

Troy, N. Y.—George L. Leatherbury, Jr., of Mobile, Ala., representing a syndicate of Troy parties, is petitioning for a franchise to build an electric railway in Mobile. The road will compete with the Mobile Light & Railway Company, a consolidation newly created, of which W. H. Patterson, of Atlanta, is president.

Wabash, Ind.—A company composed of North Manchester citizens has been granted an electric railroad franchise, covering two routes, one from this city north by way of Manchester to the Kosciusko County line, and another from Wabash south to the Grant County line. The total length of the two lines is 26 miles.

Waterbury, Conn.—Another step has been taken in the preliminary work of constructing a trolley line from Litchfield to this city.

Westfield, N. Y.—The Lake Shore Traction Company, capitalized at $280,000, has been formed to construct and operate an electric railroad, 28 miles, from here to Silver Lake. Arthur C. Wade, A. N. Broadhead, O. L. Becker, W. R. Reynolds, M. R. Stevenson and J. T. Wilson, Jamestown; A. B. Ottaway, Westfield, and Frederick R. Green and Henry D. Kirkover, Jr., Fredonia, are the directors.

Youngstown, O.—An electric street railway between here and East Liverpool is a thing of probability within a short time. Cleveland capitalists are said to be interested.

Manufacturing.

Appleton, Wis.—The contract for furnishing a new electrical plant for the Diamond Match Company of Oshkosh has been awarded to the firm of Kurz & Root, of this city. The job will include the manufacture of a number of dynamos and motors and their installation at the Oshkosh plant.

Chicago, Ill.—The firm, Hart & Co., has been formed with a capital stock of $2,500, for the purpose of manufacturing electrical machinery. J. S. Maurer, H. S. Hart and A. N. Maurer are those interested.

Middletown, Conn.—The Swan Electric Company of New York City is to locate in the Stiles Building in this place. The company manufactures electrical specialties of all kinds. The officers of the company are: W. J. Swan, president; W. J. Berge, vice-president; D. Mason, secretary; H. Metz, treasurer.

Salisbury, N. C.—The Electric Plating & Manufacturing Company will erect a building to accommodate its large and growing business.

Company Matters.

Des Moines, Ia.—The Acme Electric Works recently filed amendments to its articles of incorporation. The name is changed to the Howard Electric Company. Joe Gass, John A. Brownfield and Benjamin Howard are the directors.

Pittsfield, Mass.—The Electric Supply & Maintenance Company, now located in Troy, N. Y., will remove to this city. The company repairs motors and dynamos and deals in in all kinds of electrical apparatus.

Utica, N. Y.—It is authoritatively stated that the Utica Electric Light & Power Company and the Equitable Gas & Electric Company are to consolidate, and that the final arrangements will be completed, possibly before the first of January.

Power and Transmission.

Carlisle, Pa.—The Carlisle & Mount Holly Electric Railroad Company will erect its power plant close to Mount Holly Springs, Cumberland County, to operate its lines, and supply electric power and light to Mount Holly, and places between there and Carlisle.

Spartanburg, S. C.—C. R. Willard, of this city was recently awarded the contract for the erection of a 3,000 hp. plant for the Weaver Power Company of Asheville. This plant will furnish electrical power to run a cotton mill, a railway and lighting system, which is to be built.

Automobiles.

La Crosse, Wis.—An automobile company is to be formed here to compete with the local street car company for traffic in this city. Some of the wealthiest men have been approached on the subject and take kindly to the idea.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, December 16, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	33	36
Broadway and Seventh Avenue	100	248	249
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	180	190
Dry Dock, East Broadway and Battery	100	120	130
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	158¼	159¼
Ninth Avenue	100	196	205
Second Avenue	100	217	220
Sixth Avenue	100	175	215
Third Avenue	100	120	120¼
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	99	100
Brooklyn City Railway	100	242	243
Brooklyn Rapid Transit	100	62¼	62¾
Baltimore United Railways, com	50	15⅜	15½
do. do. do. pref	50	91	92
Buffalo Railway	100	99	101
Cleveland City Railway	100	109	110
Cleveland Electric Railway	100	85¾	87¼
Columbus (O.) Street Railway	100	43	49
Jersey City, Hoboken and Paterson	100	16	20
New Orleans City Railway, com	100	26	27
do. do. do. do. pref	100	102	106
North Jersey Street Railway	100	22½	24
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	38	40
do. do. do. pref	100	94	96
St. Louis United Railways, com	100	35⅞	36
do. do. do. pref	100	89¾	60¼
United Electric of New Jersey	100	281	282
PHILADELPHIA.			
American Railways	50	43¾	43
Citizens	50	359½	360
Columbus Railway	100	45	45½
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	65	67
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23	23½
do do pref	50	63	63¼
Dayton Traction	100	156	156¼
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151¼
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	97⅞	98
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	308½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	32½	33
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	165½	166
West End Street, com	50	94	94¼
do. do. do. pref	50	113½	114
CHICAGO.			
City Railway	100	185	185½
Lake Street Elevated	100	11½	11⅝
North Chicago	100	190	200
Union Traction, com	100	10⅞	11
do. do. pref	100	51	51¾

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23	23½
do. do. do. pref	50	63	63¼
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	47	48

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Electric Boat, com	100	19½	22
do do pref	100	44	50
Electric Lead Reduction	100	1⅞	2
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	2⅝	3
do do pref	100	4	5
General Carriage	100	1⅜	1½
General Electric	100	279	279¼
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	241	245
General Electric	100	277½	277¾
Massachusetts Electric Companies, com	100	30¾	31
" " " pref	100	94	94¼
Westinghouse Electric & Mfg., com	50	73	73¼
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	155	156
National Carbon, com	100	19	19¾
do do pref	100	83	84
PHILADELPHIA.			
Electric Company of America	50	6¼	6½
Electric Storage Battery, com	100	61	67
do do do pref	100	61	67
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	4⅝	4½
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	197	200
Narragansett Electric Company, Providence	50	92	93
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
BOSTON.			
American Telephone & Telegraph Company	100	161	161¼
Erie Telegraph & Telephone Company	100	18	19
New England Telephone Company		133¾	134
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co	100	107	110
Commercial Cable Company	100	175	184
Franklin Telegraph Company	100	47	55
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	120	123
Mexican Telephone Company	100	2	2½
New York & New Jersey Telephone Company	100	167	170
Pacific & Atlantic Telegraph	25	78	83
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		91	91½
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	106	109
Cumberland Telephone & Telegraph Co	50	133¼	133
Chesapeake & Potomac Telephone Company	100	72	75½
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		78	84
Hudson River Telephone Company	100	100	105
Northwestern Telephone Company, guar	50	122	126
Providence (R. I.) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	.

ELECTRICAL SECURITIES.

Closing Prices, Monday, Dec. 16

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1½	2
Eddy Electric Manufacturing Company	25	8	8¼
Storey General Electric	10	9	12
Consolidated Car Heating	100	50	55
Standard Underground Cable	100	180	190
Pratt and Whitney, pref	100	84	92

STREET RAILWAY BONDS.

	Last Sale.	Int. Paid.
ALBANY.		
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	125	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	116½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120[illegible]	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115¾	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 15@15¼c.; Lake, 15⅜@15⅝c.; casting, 15@15⅛c.

Amalgamated Copper made another low record Monday at 61⅞ closing at the bottom.

The Cuban Telegraph & Telephone Company, capital $2,000,000, has been incorporated in New Jersey.

Copper wire manufacturers announce a reduction of 1 cent per pound in the price of copper wire.

George J. Gould says: "We expect great things for the Manhattan when we get the change to electricity effected."

The United Traction and Electric Company of New Jersey has declared a dividend of 1 per cent., payable January 1.

An Omaha dispatch says a syndicate, formed by J. P. Morgan, is negotiating for the purchase of all street railways in Nebraska.

It is now figured that there has been a shrinkage in the market value of copper stocks this year amounting close to $200,000,000.

The executive committee of the Western Union Telegraph Company has recommended declaration of the usual quarterly dividend of 1¼ per cent.

The Birmingham (Ala.) Railway, Light & Power Company has purchased the plant of the Bessemer Electric Lighting Company at Bessemer, for $25,000, and will expend $250,000 in improvements.

The Electric Storage Battery Company has declared the regular quarterly dividends of 1¼ per cent. on both the common and preferred stocks, payable January 2. Books close December 24 and reopen January 3.

The Trenton and New Brunswick (N. J.) Railway Company was recently incorporated with $1,000,000 capital. It is said to be a link in the proposed high speed, third-rail electric system from Stapleton, Staten Island, to Philadelphia.

A prominent authority in the copper trade says: "This reduction in the price of copper is a legitimate concession to the trade. I do not think it the first gun in an international trade war. It is rather a step taken to work off the stock of copper on hand."

The Pittsburg Traction and Power Securities Company, Ltd., capital $5,000,000, has been organized to look after the Westinghouse interests in London. Its business will be similar to that of Westinghouse, Church, Kerr & Co., of New York.

The capital of the Railways Company General is $1,200,000, the par of the shares being $10 and the market value $5. The company owns $1,740,500 of stocks and bonds, and its surplus last year over charges of all kinds was $30,330, or about 2½ per cent. on the stock.

In accordance with the provisions of the lease of the Boston West End Street Railway Company to the Boston Elevated Railway Company, dated December 9, 1897, a dividend rental of $2 per share will be paid to holders of record of the preferred stock of the West End Street Railway Company on January 1, 1902. Books close December 18 and reopen January 2.

The matter of the dividend on Amalgamated Copper stock continues to be one of conjecture only. It proves nothing that one speculator should offer to sell the dividend at 1 per cent., or that another should offer to buy it at 1¼ per cent. The price on the tape argues a reduction in the rate, but to the average observer of the affairs of this company no action of the directors will prove a surprise.

Kidder, Peabody & Co., of Boston, have been requested to undertake the reorganization of the Erie Telegraph and Telephone Company. They have made an offer for the stock held by Charles W. Morse, which he is understood to be considering. It is thought that the American Bell Telephone interests stand behind the reorganization. An assessment on the stock is undoubtedly needed, as the company has debts of about $9,000,000.

Brooklyn Rapid Transit appears to be earning this year just about enough to cover its fixed charges. In the four months ended October 31, the company lost about $147,000 in net earnings, being at the rate of about $440,000 per annum. As fixed charges are probably about $200,000 more this year than last, and as the surplus last year was less than $600,000, it appears that there will be little or no surplus for the year unless net earnings begin to show increases. It is stated that the increased expenses this year are mainly for improvement work on the property, and it is expected that this policy will be continued for a considerable time. The management does not expect to pay dividends in the near future.

A special meeting of the stockholders of the New York Electric Vehicle Transportation Company will be called to vote upon a proposition to reduce the capital of the company from $25,000,000 to $5,000,000. This question was decided at a meeting of the directors held Monday, at which such a course was recommended for the stockholders to ratify. It was also decided to make the title of the company shorter by changing the name to the New York Transportation Company. The object for reducing the capital is that it will prevent any further assessments on account of uncalled stock and will also reduce the taxes. The great bulk of the money paid in recently on the second assessment is still untouched, and, with the funds in hand and to be collected, the company has abundant means to carry out its various projects. President Henry Sanderson said that the vehicle business is showing gratifying net returns, and that the business of the Metropolitan Express Company is making great strides and promises to become the chief branch of the company's various lines of business.

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EDITORIAL NOTES.

Merry Christmas!

As you come down early on Christmas morning, with eyes agog for things worth having, you will find carefully tucked away, not in your stocking, but in your letter-box—ELECTRICITY. That is to say, it should be there if the postal authorities do their duty.

It is needless to remind our readers that to-day is the happiest, and let us hope the brightest—both literally and figuratively—of the year. Our thoughts wander back to our childhood days, and we recall with a quicker beating of the heart the joy we felt as youngsters on beholding—after having risen before daylight—the very things we most longed for. As we reach man's estate this "Christmas morning feeling," as it might be termed, leaves us never to return. However, as we grow older, we enjoy our Xmas none the less in a more staid and quiet manner. We therefore wish all our friends, readers and advertisers, a very "Merry Christmas!"

* * *

Patent Classifications.

The United States Patent Office has lately made the following changes in classification: In Division 16, sub-classes are established as follows: In Class 176, electric lighting, lights, incandescent; 317, second-class conductors; 318, vapor conductors. These refer apparently to lamps of the Nernst and Cooper-Hewitt types. Class 178, telegraphy; 319, wireless telegraphs. Also sub-classes under warp stop motions as follows: 91, electrical; 92, mechanical.

* * *

Marconi and the Anglo-American Telegraph Company.

Marconi's success in transmitting a wireless telegraphy signal from Cornwall on the English coast to St. John's, N. F., as referred to at length in our last issue, has apparently created consternation in the ranks of the Anglo-American Telegraph Company. This concern it appears has the sole and exclusive rights to operate or construct any system or means by which telegraphic communication is obtained from any places in that colony or within the jurisdiction of the Government of the colony to places outside the colony. Consequently they notified Mr. Marconi that the work in which he was engaged was in direct violation of the rights and privileges granted to the company by its charter from the Government.

Referring to the matter A. M. Mackay, the general superintendent of the Anglo-American Telegraph Company is reported as saying:

"When Mr. Marconi came here he announced that his visit was in connection with proposed small stations on the southeast coast in connection with lighthouses and fog alarms, and a future extension of his system on Labrador. He mentioned that while here he would conduct a few experiments and try to communicate with passing ocean liners.

"Thinking this was the full extent of his operations here, our company did not object. It was never for one moment supposed he was going to try to obtain signals across the Atlantic, or we would, in self defence, have been compelled to apply for an injunction against him as soon as he landed here. His doing this is a direct infringement of our rights under Government charter, and my instructions are to notify him promptly, and to take necessary steps to restrain him from making any further experiments. These instructions I have carried out."

On his part Mr. Marconi says:

"I entirely disclaim any intention of infringing upon the rights of the Anglo-American Telegraph Company. I was aware that it had a monopoly here for another two years, but I thought it was simply an ordinary commercial monopoly, by which no other company could enter into competition, and I had no intention of competing in the ordinary business sense until the charter had expired.

"It seems incredible to me that this monopoly should extend so far as to prevent my making such scientific experiments as during the last week."

We would be the last to uphold or applaud the infringement of one corporation on the just rights of another, but in this case we cannot help but side with Mr. Marconi. In the first place the work which was being done by Mr. Marconi was of an experimental nature only, and could not possibly at the present time or for some time to come affect in any way the financial prospects of the Anglo-American Company. Secondly, the rights of the cable company expire in two years, and it is safe to assert that Marconi's system will not be sufficiently perfected in that time to make it commercially valuable over distances of from 1,700 to 2,000 miles. In fact it is an open question whether wireless telegraphy would ever prove as reliable as the cable for transmitting messages from say Europe to America owing to the delicacy of the apparatus, which would necessarily be more or less affected by atmospheric conditions.

* * *

The Use of Electricity in Canada.

Mr. George Johnson, of Ottawa, the Dominion Statistician, gives the following interesting information in regard to the use of electricity in Canada, particularly in respect to electric lighting. Mr. Johnson says that the number of companies in the Dominion, doing business in electricity in connection with lighting, has increased from 259 in 1899, to 306 in 1901. The arc lights in use increased from 10,389 to 12,800, and the incandescent lamps from 463,615 to 815,676. These arc and incandescent lights do not include those used and operated by private firms and companies throughout the Dominion who have private electrical plants. By reckoning each arc lamp equal to ten incandescents, the use of electricity as a light-giver has developed from 565,505 in 1898 to 943,656 in 1901. In these years the use of electricity for lighting purposes has increased by 376,171 lamps or over 66 per cent.

Of the total of 306 companies, Ontario has 196, or 64 per cent.; Quebec has 50, Nova Scotia 21, British Columbia 11, New Brunswick 11, Manitoba 6, Northwest Territories 5, and Prince Edward Island 3. With respect to the number of lamps in use, the Province of Ontario has 6,830 arc and 384,496 incandescents, or about 48 per cent. of the total for the Dominion. Ontario cities, towns and villages have availed themselves of electricity as a light bearer to a very great extent. There are 78 of them which have either municipal plants or are supplied by companies, some of these towns have more than one electric plant. The city of Toronto has 1,450 arc lamps and 80,000 incandescents, equal to a total of 94,500 incandescents. Ottawa has 585 arcs and 80,000 incandescents, or a total of 85,850, counting each arc lamp as equal to 10 incandescents. Hamilton has 560 arcs and 22,295 incandescents, or 20,680 of a total.

The Province of Quebec has 4,118 arc lamps and 270,120 incandescents; or reduced to the standard of incandescents, a total of 311,300 electric lamps. The city of Montreal has of these, 2,648 arcs and 108,210 incandescents, or a total of 134,690. In all, there are 42 cities, towns and villages in Quebec Province which have plants for the manufacture of electric light; 22 of them are in the Eastern Townships. Among these Montreal has about 43 per cent. of the total number of lamps in the province. Quebec city has 600 arcs and 43,000 incandescents.

Of the other provinces, Nova Scotia's total equipment of 465 arcs and 49,041 incandescents is distributed among 20 towns and is furnished by 21 companies. New Brunswick's total equipment of 691 arcs and 18,131 incandescents is distributed among 10 cities and towns and is furnished by 11 companies. Prince Edward Island's share in the total of Canada is 3 companies, 92 arcs and 9,525 incandescents. The Province of Manitoba has 6 towns provided with the electric light and its equipment is 22 arcs and 19,250 incandescents. The Northwest Territories possess 5 equipments with 31 arcs and 5,875 incandescents, divided among six towns. British Columbia distributes its lighting by electricity among a dozen towns, and has a total of 14 plants, with 643 arc and 62,763 incandescent lamps.

The increase in the use of electric lamps in Canada, in 1901 over 1900, was 144,556 lamps; of 1900 over 1899, 142,858 lamps; and of 1898 over the preceding year, 78,757 lamps, reckoning in each case one arc as equal to ten incandescents.

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

Signor Marconi sent the following cablegram from St. John's, N. F., to Thomas A. Edison Monday evening. "Thanks for your very kind letter to the press. I hope soon to show you wireless telegraphy working between the United States and Europe. I wish you a happy Christmas." Signor Marconi will be honored by the Dominion Government when he goes to Canada from St. John's to-morrow night. He will be met at Sydney, Nova Scotia, by a Government official.

In Milwaukee, Wis., it is proposed to employ on bridges turned by electric power only young men who have some knowledge of electricity, and it is also proposed to place the appointment of them within the jurisdiction of the city service board.

A dispatch from St. Petersburg states that the Navy Department has decided to fit Russia's warships with wireless telegraphy apparatus. The system to be installed is that invented by Professor Popoff.

There is a report to the effect that Mr. Payne, the new Postmaster-General, is in favor of Government ownership of telegraphs. It is more than possible that he will be called upon to handle the subject during his term.

It is estimated that London alone lost nearly $1,000,000 by the breakdown of the telegraph wires in the recent storm. The British Government objects to putting the wires underground because of the expense and difficulty of working wires in that way.

The newest ailment proclaimed by science is the "auto squint." In describing the disease it is said that the "pyramidalis nasi is set at high tension and the levator labii superioris alaeque nasi is drawn tight. This distorts the orbicularis oris." So look out, now that you know what the disease is.

When Mr. Frank A. Vanderlip resigned as Assistant Secretary of the Treasury he went abroad with letters to all the ministers of finance in Europe, and spent many months investigating the financial and commercial situation, with particular reference to the inroads which American trade is making on the whole world. The first of his articles on the "American Invasion" of Europe will appear in the January "Scribner's." One of the questions which Mr. Vanderlip discusses is, "If we go on selling $600,000,000 a year more than we buy, how will Europe settle this great trade balance?" The author found that every financial minister of Europe and the head of every imperial bank was exercised over this serious problem. The illustrations to accompany Mr. Vanderlip's articles show American machinery and American inventions in use in almost every known region.

A dispatch from London says the electrical generators to be laid down at the station in Chelsea Creek under the Yerkes underground railway electrification scheme will be the biggest in the world, each developing 7,000 hp. and driven by a turbine engine of 400 tons. Each generator, it is estimated, will be capable of giving out power equal to half a million men, the total maximum horse-power being 100,000.

Recent news from Baltimore, Md., states that the Federal Wireless Telegraph & Telephone Company has completed its station on Stafford street. The company intends to establish a station in the middle of the city as soon as the other stations are completed. The first circuit of stations will be from Washington to New York, and will have stations in Baltimore, in Wilmington, Philadelphia and Trenton. The basic feature of the system used by the company is incorporated in the Dolbear patents. This, however, has been considerably modified, and, it is claimed, improved. The most successful test the company has had so far, it claims, was in reporting the yacht races.

Signor Marconi says "that if his system of wireless telegraphy can be commercially established between the different parts of the earth—a possibility of which he has not the slightest doubt—he believes that the cost of transmitting messages across the Atlantic will be reduced to 1 cent per word or less."

A representative of London "Lightning" writes as follows to that paper: "It is not easy to accustom oneself to Dr. Lodge's suggested view that the inertia of matter is to be explained by self-induction, and more must be known about electrons before they can be made the basis on which the foundations of dynamics shall rest. The analogy between the mathematical expressions of the several forms of electrical energy, and the corresponding expressions for mechanical energy, is striking and may possibly be fruitful, and the experiments selected by Dr. Lodge were singularly apposite—some of them have been used before at the Royal Institution. I can hardly credit him, however, with having put down C^2R as a form of electrical energy, unless it were by sheer inadvertence that he omitted the time factor. I am very glad to see the professor throwing the weight of his authority into the scale against the nonsense of calling resistance a velocity and self-induction a length but I doubt whether he betters matters much by putting the whole responsibility of our ignorance on the little coefficient μ. 'What is μ? I wish I knew,' he asks, dropping, like Mr. Silas Wegg, into poetry; and question and reply intimate together the fallaciousness of the dimensional method of research, in which symbols are used without definite meaning being assigned to them, and the secrets of nature are looked for in the mists of an arbitrary notation. It was not for this that Fourier devised the theory of dimensions of physical quantities: *he* knew the meaning of every symbol he used."

It was reported last week that the New York Electric Vehicle Company, which controls the Fifth Avenue Coach Company, proposes to extend its service to Riverside Drive and as far north as Macomb's Dam Bridge. Electric stages will make regular trips from 124th street south through Riverside Drive, where passengers may change for other downtown stages.

◆

A long known bed of gold-bearing ore in Georgia has just become accessible through the installation of an electric water-power plant. While the ore only assays from 50 cents to $2 a ton, it is now being worked commercially. Power is supplied by a waterfall some 12 miles distant. At the point of utilization a large reservoir has been built and the water for the hydraulic mining is forced into it by means of powerful electric pumps. The stamp mills and crushers are operated by electric motors. The cost of handling these low-grade ores is given at 10 to 15 cents a ton, exclusive of interest on the plant, a remarkable figure. The cost of fuel in this locality is prohibitively high, so that it was not until the electrical development of the region that the working of the ore became a commercial possibility.

◆

The Secretary of State has transmitted to Congress an ordinance enacted on February 27, 1901, by the the executive council of Porto Rico, granting a franchise to W. H. S. Lothrop, for the purpose of constructing and operating an electric street railway in certain streets of Ponce and between that city and the playa thereof, for a period of 60 years. The entire line is to be completed and in operation within one year from the date of the granting of the franchise.

◆

A cable dispatch from London to the New York "Herald" says: "The disbelief of many English scientists in the claims made by Mr. Marconi that he has succeeded in sending wireless telegraphic signals across the Atlantic, which is, however, now giving place to belief, recalls the fact that, in 1879, when a committee of Parliament was appointed to investigate the utility of the electric light as a means of illuminating cities and the practicability of telephones, one of the men who expressed his doubt of Marconi's success most strongly then made rather a remarkable prophesy. He gave it as his opinion that the telephone would never supersede the telegraph or come into popular use in London. It might in America, he said, where people were in a hurry and labor was scarce, but in England, particularly London, there was such an abundance of labor that there would always be enough men and boys to carry messages cheaper than the cost of telephoning. The same prophet now says there is no commercial future for wireless telegraphy."

◆

Plans for electric railways between Baltimore and Washington and Baltimore and Frederick City, Md., will soon be completed, and construction will begin in the spring. The Laurel and Berwyn Railway Company has been incorporated to construct a line between Berwyn and Laurel, Md., connecting at the former place with the City and Suburban Railway, operating between Washington and Berwyn. A syndicate of Cleveland capitalists will construct the lines from Laurel to Baltimore and also a branch to Annapolis, Md. A company in which Fielder Slingluff, Milton Offutt, D. B. Banks, Frank Callaway and other Baltimoreans are interested will be organized early in January with a capital of $1,000,000 to construct a line from Baltimore to Frederick. Much interest is manifestsd in the project, and property owners along the proposed route are making liberal offers to secure the new line. The surveys contemplate effecting a connection with the proposed Washington, Westminster and Gettysburg electric road, the route of which has been surveyed. A road from Baltimore to Belair through the northern part of Maryland will also be constructed next year.

◆

The Reuterdahl electro-chemically formed plate, manufactured in Providence, R. I., is combed by a new process invented by the company until the surface of the lead plate is increased to such an extent that the area exposed to the electrolytic action is from 10 to 20 times the superficial area of the plate. This process is used particularly for central station plates, where size and ability to stand abnormal conditions in charge and discharge are essential The process is applied to plates of all sizes.

◆

Within a short time all the big guns on Sandy Hook will undergo official tests with electricity as a necessary accompaniment. The heavy ordnance will be elevated and lowered by electricity, ammunition will be swung into the breeches by the same power, and in fact all the delays now incident to hand power and its accessories will give way to wires and switchboard. The introduction of electricity on Sandy Hook will greatly facilitate the work of testing big guns, and in the end save thousands of dollars each year to the Government. With the installation of electricity Sandy Hook will also have a great improvement in its light. Gas lamps will be replaced by incandescent bulbs and arc lights. The barracks will also be lighted by electricity, together with the fortifications and the grounds exclusively devoted to gun tests. At present the only power on the Hook is used in lighting up the two channel range lights.

◆

An electric mouse trap is a recent novelty to aid in exterminating the pests which infest dwellings and other buildings. There is no complicated mechanism about the trap; in fact, it is so simple that the wary rodent is not at all likely to regard the device with suspicion. Everything is in plain sight, and the animal is not compelled to insert its head in a noose or to enter a cage in order to reach the bait. In this case the tempting morsel is suspended within easy reach, but the instant the electrical circuit is completed by the rodent itself, death ensues without the bait being disturbed. The trap consists of two metallic plates, connected by wires to an electric light circuit, the plates being insulated by a sheet of non-conducting material placed between. The bait holder is suspended from a supporting arch secured to the outer plate. There are numerous small animals which may be captured in this way, and the inventor also intends it for use in destroying roaches and bugs of various sorts. The electrocution is accomplished by the passage of the current from one plate to the other through the body of the rodent or insect

JOSIAH LATIMER CLARK.

While the scientific press of this and other countries has made liberal mention of the fact that the American Institute of Electrical Engineers received, at its last annual meeting, the exceedingly valuable collection of works, chiefly upon electricity and magnetism, made by the late J. Latimer Clark, nothing has as yet been said of the one through whose unremitting care this unusual assemblage of rarities was made possible.

The subject catalogue, now being prepared at the rooms of the American Institute of Electrical Engineers, and which is to be immediately followed by a catalogue raisonné, already gives a satisfactory idea of the extended scope which the library must needs cover when all the sets of scientific publications shall have been brought up to date.

The Late J. Latimer Clark.

Josiah Latimer Clark, F.R.S., M. Inst. E.E., M. Inst. C.E., was born at Great Marlow, in Buckinghamshire, March 10, 1822, and was eight years the junior of his brother, Edwin Clark, the well-known engineer, who died October 22, 1894, at the advanced age of 80.

Latimer Clark, as he called himself, received, like his two brothers, a good elementary education, and, at a comparatively early age, evinced a marked preference for the study of chemistry, which led to his being employed in a technical capacity by one of the largest Dublin manufacturers, until early in the forties, when, attracted by the extensive development of railway construction, he attached himself to several surveying parties and finally served a term of pupilage as an engineer with his brother Edwin on the Chester & Holyhead Railway.

During the year 1848, Latimer Clark was engaged by the late Robert Stephenson, as assistant resident-engineer on the construction of the Britannia Tubular Bridge, upon which Edwin Clark had previously employed him as general superintendent. They both retained these positions until August, 1850, when Mr. J. L. Ricardo induced them to enter his then newly-formed Electric Telegraph Company, as engineer and assistant-engineer respectively. Four years later, Latimer succeeded his brother, who had resigned the position of engineer-in-chief, and he remained as such until the year 1861, when he became the company's consulting engineer, which post he held up to the year 1870, when the General Postoffice Department took over the entire telegraph business of the United Kingdom.

Throughout this period Latimer Clark introduced many very important improvements in the telegraph system and was enabled to materially assist the Astronomer-Royal in developing the necessary electrical arrangements, for the simultaneous distribution of time throughout Great Britain from the observatory at Greenwich and for the determintion of longitudes of various places. To Mr. Clark is due the very valuable suggestion, made in 1857, that magnetic observatories should be furnished with wires extending out toward the four cardinal points, so as to act as feelers in connection more particularly with approaching storms. He at this time made several discoveries, which have been largely represented in patents and a few of which would alone suffice to have given him a prominent name.

In 1853, he invented a camera for taking stereoscopic pictures with a single lens and during the same year he conducted a series of investigations on the subject of electric currents through the underground telegraph wires which had been laid between London, Leeds and Liverpool. During the course of his researches he was the first to observe experimentally the retardation of electric signals in submarine and underground lines and to demonstrate that "currents of low tension travel with the same velocity as currents of high tension." At the request of Sir G. B. Airy, the Astronomer-Royal, as well as of Professor Melloni, some of the experiments were repeated before Professor Faraday and formed the subject of a lecture delivered before the Royal Institution in January, 1854.

In 1855 Mr. Clark was appointed chief-engineer to the Electric and International Telegraph Company, which supplied telegraphic communication for nearly every railway in the United Kingdom, and for which concern, when operating under its original name of the Electric Company, he had already superintended the laying of cables to Holland, Belgium and other countries. During the year following, he invented and patented the most perfect known form of earthenware insulator, known as the "double cup invert," which is now made use of wherever electric wires are carried overland.

He gave much study to the possible means of lengthening the lives of submarine cables, many of which had been found worthless, mainly through the effect of rust, after even as little as four or five years' service, and, during the year 1858, he placed upon the market what is known as "Clark's Compound," with which the cables were covered and which has frequently proved serviceable for as long a period as twenty-five years.

Latimer Clark was appointed engineer to the Atlantic Telegraph Company in 1859, and in 1860 became a member of the committee organized to inquire into the whole subject of submarine cables. In June of the last named year he became professionally associated with the late Sir Charles Bright, under the firm name of Bright & Clark, and a joint paper by them was read at the Manchester meeting of the British Association, entitled "The formation of Standards of Electrical Quantity and Resistance." The subject attracted considerable attention and a committee of the British Association was formed, with Mr. Bright and Mr. Clark as members, the result of their labors being the system of electrical units now in universal use, and the original names of "Ohm," "Farad" and "Volt," as proposed by the writers, being permanently adopted.

In 1863 the partners were entrusted by the Indian Government with the supervision of the construction of a cable of great strength and durability across the Persian Gulf, and, in connection with the engineering work, they carried out numerous experiments to ascertain the effects of temperature upon the insulation of gutta-percha. These were fully described in Sir Charles Bright's paper entitled "The Telegraph to India, and its Extension to Australia and China," read by him before the Institution of Civil Engineers in 1865.

The partnership of Bright & Clark was dissolved September 25, 1868, and, during the early part of the year following a new association was made by Mr. Latimer Clark, Mr. Henry Charles Forde, Mr. Charles Hockin and Mr. Herbert A. Taylor under the firm name of Clark, Forde & Taylor. Mr. Clark also formed a partnership during 1874 with Mr. John Stanfield and likewise became a partner, during 1875, in the firm of Clark, Muirhead & Co., as the outcome of Warden & Company.

Besides being an engineer, in its broadest sense, Mr. Clark was a devotee of astronomy, as might be inferred from his early relations with the late Astronomer Royal. He at one time constructed quite an extensive observatory, and, during the year 1852, he brought out his little transit device, which, it is said, has done more perhaps than anything else to popularize this branch of science.

Special mention should here be made of the paper which Mr. Clark communicated to the Royal Society through Sir William Thomson (now Lord Kelvin) during the year 1873, entitled "A Standard Battery of Constant Electro-motive Force." This zinc-mercury standard cell—the practical standard for the accurate measurement of electric potentials—is no doubt what, as much as anything else, will hand down the name of Latimer Clark to posterity in electrical science, for the use of this invention in the laboratory as well as in practical testing is almost unbounded.

Another meritorious paper of his appeared the same year in the journal of the Society of Telegraph Engineers. It is entitled "On a Common Source of Error in the Measurement of Currents of Short Duration When Using Galvanometers with Shunts," and is a singularly able study of the errors due to the inductive action of a galvanometer needle upon its own coil when using shunts of different values in a series of comparative discharges.

On the 13th of April, 1858, Mr. Clark was elected an associate of the Institution of Civil Engineers, and on the 19th of November, 1861 he was transferred to a full membership. He became a Fellow of the Royal Geographical Society in 1862, a Fellow of the Royal Astronomical Society in 1874 and a member of the Physical Society of London in 1875, the same year that he became the fourth president of the Society of Telegraph Engineers (now the Institution of Electrical Engineers) of which he was one of the original founders and a life trustee. In 1889 Mr. Clark was elected a Fellow of the Royal Society, having some years previous been created a chevalier of the Legion of Honor.

It should be mentioned that Mr. Latimer Clark's address, upon taking the presidential chair of the Society of Telegraph Engineers, January 13, 1875, contained an exceedingly interesting and very valuable account of the early history and development of the electric telegraph. He carefully traced the progress of telegraphy and showed, amongst other interesting facts, that, from the time of the transfer of the system to the Government, January 28, 1870, the number of yearly messages had increased from 6,000,000 to 11,760,000 in 1871, to nearly 15,000,000 in 1872, to over 17,000,000 in 1873 and to 19,116,634 the year following, and that, instead of retarding, as many believed, the progress of general inventions, the Government had done all in its power to develop them. The most interesting feature of the proceedings was, however, the announcement that the fine library of electrical works collected by the late Sir Francis Ronalds had been transferred in trust to the Society, with reversion to the Royal Society in the event of the dissolution of the Society of Telegraph Engineers. The will of Sir Francis Ronalds, who died August 8, 1873, bequeathed the collection to his brother-in-law, Mr. Samuel Carter of Battle, who thus transferred it in fulfillment of Sir Francis Ronalds' desire "that it should not be dispersed, but should be preserved in an entire state, and so as to be of as much use as possible to such persons as from time to time should be engaged in the pursuit of electrical science and other cognate sciences." Mr. Latimer Clark was one of the trustees named in conjunction with Mr. Samuel Carter, Dr. Edmund Ronald, Mr. John Corrie Carter, Mr. John Martineau Fletcher, Sir William Thomson, F.R.S., D.C.L., Prof. Charles William Siemens, F.R.S., D.C.L., and Lieut. Col. Frank Bolton.

Throughout his whole life, Mr. Latimer Clark showed himself an indefatigable lover of books, and he fortunately had the means, and found the leisure, to gratify his tastes at a time when the increased demand had not yet made many of the old volumes inordinately scarce and had therefore placed them, as most of them now are, beyond reach of the ordinary collector. His library, which, as has already been stated, was given to the American Institute of Electrical Engineers at its last annual meeting, has thus far been unequalled, as regards electrical works more particularly, and it contains a greater number by far of actual rarities than does the well-known collection of the late Sir Francis Ronalds, which, as has been seen, Mr. Clark was instrumental in presenting to the Society of Telegraph Engineers.

At the time of his death, at Twickenham, Sunday October 30, 1898, Mr. J. Latimer Clark was in his 77th year. He was buried at the Kensington Parochial Cemetery near Hanwell Middlesex.

* * *

Electricians are fitting Lightship 71 at the Baltimore, Md., dry-dock for the installation of a searchlight, with which the vessel will be fitted before she resumes her place on Diamond Shoal, about Jan. 1. The light is to be located forward so it can be trimmed to any point and the expectations are that it will be seen fully 30 miles away. It will be the first time electricity has been used as a guide by lightships.

PRINCIPLES OF DYNAMO CONSTRUCTION.—VII

(Written for Electricity.)

Magnetic Leakage.

Iron when magnetized, becomes polarized; each small particle arranges itself in a definite manner with respect to the next particle. This being the tendency it necessarily follows that iron possessing grain will assume this condition more easily than metal of irregular molecular structure. Therefore, one of the first points to notice is the character of the metal used as a framework for the dynamo. It has already been shown that cast-iron has a lower specific induction than wrought-iron. It is also true that in proportion to its dimensions it has a greater factor of magnetic leakage. Cast-iron frames were commonly used until a recent date; then makers who used wrought-iron cores and cast-iron frames gradually turned their attention to cast steel as a substitute for cast-iron. The superior permeability of steel made its value magnetically, as compared with cast-iron, two to one.

Leaving this subject of material for a while, it is instructive to turn the attention to the more direct causes of leakage and the percentage or coefficient of leakage for different field frames.

Corners and points act as if they condensed the lines of force and allowed a streaming effect to take place. It therefore follows that in the design of a type of machine it is the best practice to avoid as far as possible such irregularities. Another point of interest well worthy of attention is the necessity for as great a distance as possible between points of opposite polarity for obvious reasons.

GENERAL EFFECTS OF LARGE AIR GAP, HIGH INDUCTION AND NEARNESS OF OPPOSITE POLES.

It is surprising to note the large value which the coefficient of leakage assumes for certain types of frame, especially when the above points are disregarded. In small frames the leakage is greater than for larger frames of the small type, because, if the same specific induction be observed in the cores of their respective magnets, the parts of the smaller framework are nearer together for a given magnetic density than those of the larger; therefore the leakage between any two given points is greater. Another point to be noted is the fact that in the air gap of a smaller frame, the space between the armature core and the polar face is greater in proportion to its size than it would be for a larger frame.

The leakage becomes greater as the magnetic induction passes a certain point, due to the fact that the permeability approaches that of air as the specific induction increases; therefore the likelihood for greater leakage increases and the lines of force thread the air in greater numbers.

Hopkinson investigated the subject and remarks the difference that occurs between the characteristic calculated for and the curve obtained. These differences were virtually due to the leakage and certain unexpected areas supplying lines of force to the armature core.

The characteristic curve of a dynamo expresses the relation between the current and EMF. that it develops.

It can be shown that the EMF. and current are mutually related. By establishing such a relation we can delineate graphically the resulting curve obtained by plotting current and magnetizing force.

The actual value of the leakage in a type of single horseshoe frame has been estimated by test and otherwise to be between fifteen and one hundred per cent., according to the size of the machine. It has already been stated that the leakage between two points of opposite polarity depends entirely upon the permeability and reluctance of the medium between them.

The greater the permeability of the frame and the greater the reluctance of the space through which leakage may occur, the less we will actually realize. Therefore, in large types of machines in which these quantities approach their minimum and maximum values, it is easily seen that the percentage of leakage is at its least if due attention has been paid during design to the fact that points, corners and any projections whatsoever, are features that tend to cause excessive leakage. When a frame is cast with projections from the pole-pieces, between which the bearing is constructed, it is usual to find great magnetic leakage in such cases. Therefore it seems inevitable to have leakage whenever there is a quantity of projecting iron in the neighborhood of the polar extremities.

Perhaps leakage is least in those types of iron-clad machines in which care is taken to have a great distance between the pole-pieces and iron framework; that is to say, the inside core surface and the inside opposite and parallel frame surface. It must be understood that in all these cases the nearer the armature core is to the source of magneto-motive force, the sooner the lines of force will pass directly into the armature, and consequently reduce the change for radiation of lines of force before it is reached.

Parallel magnet cores are one of the causes which tend to increase the leakage. Were the magnet cores of the single horseshoe type made to diverge, the leakage would be reduced in the proportion of seven to six, showing a decrease in leakage of sixteen per cent., with frames of one-tenth horse power. Though this proportion rapidly decreases when we examine into the leakage, resulting from type frames of twenty-five to one hundred hp. or over; due to the fact that the distance between points of opposite polarity has increased. The Manchester or consequent pole type is in reality the coalescence of two separate magnetic circuits into one. One pole-piece being the common junction of one pair of polar extremities and the other being likewise constructed, so that between these two polar faces the armature may be revolved. By passing a plane through this type of frame so as to make a longitudinal section of the armature, we immediately obtain the type of single magnet frame which, by examination, seems to be practically the single horseshoe type minus its keeper. The consequent pole type of machines, under which is included the iron-clad type, derive their names merely from the relative position of their field windings upon that type of continuous iron frame. The Manchester type has its field windings upon that part of the frame which in the iron-clad type gives to it its characteristic name. Extend the pole-pieces of the Manchester type, place upon one or both of the pole-pieces the field windings, lengthen the machine in the direction of its armature shaft, and we have at once the iron-clad type. By dividing the winding into four parts and winding near the corners of that part of the casting which makes it iron-clad, and we arrive at a type of machine invented by Weston. This type is called the double horseshoe type. By taking two single horseshoe frames and using but one pair of pole-pieces having the keepers extended downward to serve as supports, we arrive at exactly the same design. The Manchester type of field, which by an extended application has been shown to cover so many other types of frame, is one of very popular use. Its leakage in small sizes of a few horse power, or less, is very high, because of the nearness in most cases of the pole-pieces to the magnet core with a high specific induction in the iron. This objection can be entirely removed by stretching out the machine at right angles to the armature shaft; that is to say, by separating the magnet cores from each other and from the pole-pieces. It is not an exaggeration to place the leakage of this type at one hundred per cent. in small sizes, of one hp. or less, and at an average of sixty per cent. for sizes within twenty hp., these figures decreasing, as remarked before, with the increased size of frame. It is a usual practice to extend the lower pole-piece of this machine into a support for two bearings, one on each side of the lower pole-piece; the pole-piece base plate and bearings then being of one polarity. This is a most substantial type of machine from a mechanical standpoint. It being cast in two pieces, the upper portion connecting the two magnet cores and containing the pole-piece, forming one casting; the lower part, including the base plate, pole-piece and magnet cores composing the other casting.

In some cases though the practice seems to have been discontinued, one bearing would be cast with the base plate and the rest. It becomes a simple matter with such a design, to slip the field windings over the cores and then bolt the upper portion in place. We might consider in this type the winding to be upon the respective keepers of the two halves composing the total magnetic circuit. If it were not for the fact that a false impression might be conveyed to the reader, leading him to consider magnetism in the same light as electricity, as having a flow, it would be a good guide to include all types under two general headings, the series and the multiple field type. Magnetic circuits as a rule are of the latter type, and in the styles of dynamos called multipolar machines, there are always four or more multiplicate magnetic circuits, two forming respectively one pair of poles, and two another. Many of the present types of alternating current dynamos also use a form of field identical with the multipolar.

The third type of field frame is the iron-clad type. This has the advantage of being a thorough shield to the magnetism within. It is a form of frame that is compact and self-contained, and possesses the additional qualification of mechanical strength and stability. The field coils can be completely inclosed bearing upon the armature and exercising their immediate influence upon it.

It may be remarked now that in all frames in which there is not a perfect magnetic balance above and below a horizontal plane passing through the axis of the armature core, there will be heating at the bearings, due to the fact that there is either an upward or downward pull on the armature, caused by the uneven distribution of the lines of force in the pole-pieces. Single horseshoe types, which have not the proper cross section of iron at that portion of the pole-piece furthest from the keeper, suffer from a pull on the bearings toward the keeper because of the lines of force being crowded toward the two inner horns of the polar extremities. In the Edison type the claim is made that the weight of the armature balances this upward pull. Therefore it is easily seen that a symmetrical field is a necessary object in design. It is possessed in common by all types of consequent pole machines. In the true iron-clad type of machine, the leakage is less than would be supposed. The shorter the pole-pieces, the less in area became the parallel faces between which leakage occurs, the shorter becomes the magnetic circuit and the more compact the machine. Leakage varies in this type of bipolar iron clad machines from thirty to fifty per cent. for small sizes of frames and diminishing to an average of about twenty per cent. for larger types approaching seventy-five to one hundred and fifty hp.

As all these conditions in detail represent in the concrete the sum total of the results so repeatedly obtained from numerous tests, a slight resumé of the subject will be both interesting and instructive.

A deflection is obtained in a ballistic galvanometer by connecting it to a temporary coil surrounding the magnet coil; this is divided by the deflection obtained by having the coil then surround the armature core; the quotient obtained will be the coefficient of leakage. If the first kick of the galvanometer when the circuit is closed be 200° and the kick due to the lines of force in the armature be 160°, then the ratio observed will be expressed by $\frac{200}{160} =$ 1.25; which means that for every 125 lines of force produced in the field coils 25 of them will leak away before they reach the armature core. Therefore, if our calculation for electromotive force necessitate the passage of 100 lines of force in the armature, the leakage factor immediately come into use for the determination of the number of lines of force that must be generated in the magnet cores equal to $100 \times 1.25 = 125$.

By a casual examination of the different types of frames they may in general be reduced to a few forms, from which all others may be considered as mere elaborations. The names of these special types may be called successively the horseshoe, the Manchester and the iron-clad type. One of the first that appeared in the history and practice of electrical engineering was the horseshoe frame, consisting merely of two magnet-limbs or cores having a common keeper at one end and a cylindrical cavity at the other extremities for the insertion and necessary rotation of the armature. This type has been used in the inverted form, that is to say, the keeper has been a casting so designed as to allow of its use as base or foundation for the machine.

Rising upward from an extension of the keeper are two bearings upon which the shaft rotated, thus making a most solid, substantial and convenient form of dynamo frame. Under the heading of this last-mentioned type were constructed a great variety of commercially successful machines.

The Edison and other companies manufactured this single horseshoe type, but let it rest upon its pole-pieces, thus having the armature nearer to the ground than in the other method of suspension.

NOTES ON PRACTICAL ELECTRICAL INSTRUMENT MAKING.—II.*

BY JOHN C. BAGOT.

When, however, greater delicacy and sensitiveness is required than can be obtained with the instrument already referred to in a previous article [see issue of Dec. 11, page 329], a class of instrument is employed in which the needle system is free to move in the azimuth only, suspended either between pivots, or by a fiber of unspun silk, or poised on one single pivot by means of an agate cup, in which case, however, the needles have to be of a special design, to admit of the pivot passing through one of them. In the case of an astatic pair the multiplying action of the current is here utilized to a much greater extent, and further, the directive force of the earth's magnetism is, by the arrangement of the moving magnets, either completely counteracted or considerably reduced. The action of the current, and the consequent deflection of the needles on the passage of a current in the direction shown by the arrow heads, will be sufficiently illustrated by Fig. 5. Then, providing the suspended magnets are exactly similar both in dimensions and magnetism, and are placed so that one lies vertically above the other, with their opposite poles in the one direction, the system will come to rest in any position when not influenced by the current. But an astatic pair of needles is an ideal condition very seldom attainable, but a near approximation may be got by carefully selecting the steel and filing both needles together, so that they are exactly the same shape when finished, and by magnetizing them in the opposite direction, which when finished will obviate any slight irregularity that may have occured in the shape.

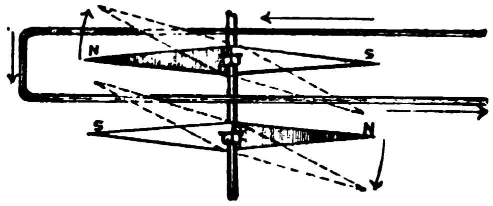

FIG. 5.

In regard to the coils, the best forms are those built up with brass pillars, and flanges of either brass or ebonite, so that the coil is free from metal in the inside. These may be secured in the ordinary way by means of a lug to the base or false bottom of the instrument in the manner illustrated in Fig. 4. Although the coils of many such instruments are constructed in the manner shown in Fig. 6, the inside of the coil being in the form of a flattened brass tube, in which there is left a gap in the direction of the length, the object of this longitudinal slot being to decrease as far as possible the damping influence of the currents set up in the brass tube by the moving magnets inside. The coil flanges should therefore be of some non-metallic substance, or the object of the slot, to a very great extent, will be defeated by soldering the flanges across the gap made for a specific purpose. This damping influence, as regards the actual deflections, may be a decided advantage in preventing vibrations, but the same damping action prevents the needle returning to zero, as it would otherwise do under other conditions.

These currents set up in the coil frame are not dependent on the current passing through the wire, but simply on the velocity with which the magnetic needle within them moves. Thus, although such instruments are perfect in many respects, yet for the indication of very weak currents, such as the balancing point, when measuring resistance by Wheatstone bridge, they will be found not so reliable, for at that instant the current passing through the coil tending to cause a slight deflection is not greater than the opposing current that would be set up on the movement of the magnetic needle, consequently on making contact the needle makes a faltering movement, finally settling down somewhere about zero without the balance being perfect. There does not appear to be any advantage either from a mechanical or financial point of view in building up the coils in the above manner, for the coils should be wound in opposite directions relative to their position, so that they require moving on the mandrel and winding independently. The most delicate astatic instruments are those in which the coils and dial plates are non-metallic.

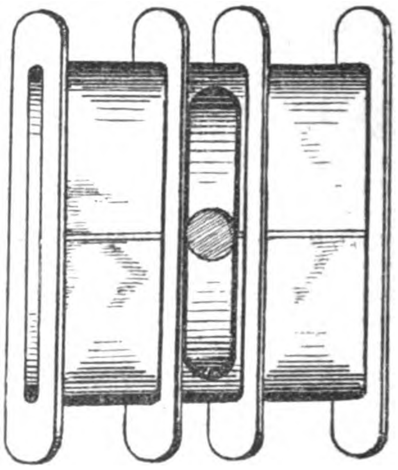

FIG. 6.

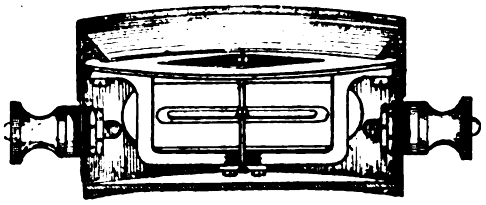

FIG. 7.

A very good form of circular case astatic galvanometer is shown in Fig. 7, where part of the case and the bezel is cut away, and with the top bridge and one of the coils removed also, showing the axle and bottom jewel plate in position. One great advantage of this form will be obvious—that is, on the removal of the bezel, the dial, together with the bridge, axle, and coils complete, with all the working parts, can be "with the exception of the terminal connections," removed free from the case, which make adjustment and repairs comparatively easy. With the bottom jewel hole being attached to the back of the large bridge, "through which there is a clearance hole," it is a very simple matter to set the axle in a vertical position. Also by this form of instrument there is no necessity for a slot in the dial plate. It will be noticed in the figure that the ends of the screws which secure the coils and large bridge are arranged so as to be out of sight under the bezel flange.

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*From the "Electrical Engineer," London.

The one important property of a magnetic field, whether of a permanent magnet or a solenoid, is the resistance it offers to the interference of another magnetic force, and the determination of the amount of this interfering force, or resistance offered, is the principle upon which many of the most accurate and important measuring instruments depend. The original instrument of this type was designed by Deprez and d'Arsonval. In the first place some permanent and invariable magnetic field is necessary, in which is suspended the coil through which the current that is to be measured passes. This magnetic field is maintained by a large permanent horseshoe magnet, the form of which is shown in Fig. 8, along with the suspended coil, which takes the place of the suspended magnets in the previous illustrations. In order that the space betweeen the magnet poles should be more permeable, there is a block of soft iron supported in position so as to leave a clear space for the movement of the coil; if this iron were not as shown, a great number of the lines of magnetic force would leak out without passing through the coil. The action of this instrument is identical with that of a motor having a separately excited field, and, therefore, the forces acting on the coil are proportional to the number of magnetic lines which are embraced by the coil, and to the number of turns of wire in the coil, or, in other words, proportional to the strength of the field and ampere turns. The coil in the illustration is shown deflected to its maximum position, to which it is not advisable to work it, but this is easily obviated by placing a rubber band round the poles so as just to come in contact with the coil and arrest its movement.

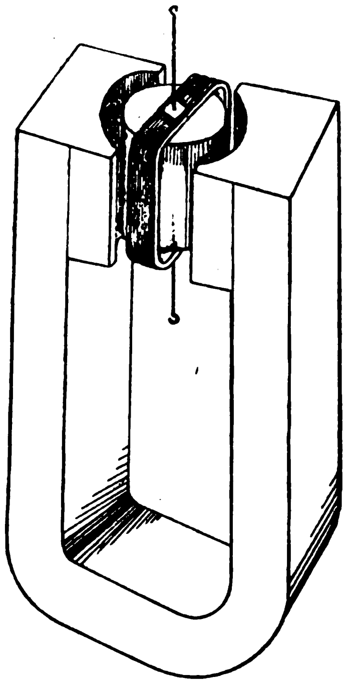

Fig. 8.

The important property of this instrument, which is again identical with the motor, is the cause of the instrument being what is termed "dead beat," which is the result of the back EMF. generated in the coil when moving in the field of the magnet. Now, this back EMF. depends on the speed with which the coil moves, the number of turns of wire on the coil; and since this back EMF. tending to force the coil in the opposite direction depends upon the resistance of the circuit in which the instrument is worked the number of turns and the strength of the field, the amount of this damping action is to a great extent in the hands of the maker. By the resistance of the circuit is here meant whatever is connected in series with the coil of the instrument. Since the velocity depends upon the current, therefore the damping action is always proportional to the deflecting current for any particular instrument. In order that the movement of the coil may be slow, the field of the permanent magnet should be considerably stronger than that set up by the coil when influenced by the current. The two electrical conditions which determine the sensitiveness of these instruments are: (1) the number of turns of wire on the coil; (2) the strength of the field in which it is suspended.

The essential mechanical point of the instrument in respect to the coil and its suspension will be seen from Fig 9. The coil is suspended by a fine wire, or tape, of either silver or phosphor bronze, which also serves the purpose of conveying the current through the coil. The method of securing this suspension, and the means adopted so as to keep it under tension, is also made clear in the illustration. The soft-iron block in this case is shown fixed in position, in which it is held by means of two iron screws from the back of the brass block, shown at B. The large brass plate which is fitted with the pillar, "which also supports the top suspension and regulating devices," is fastened on to the poles of the magnet by means of iron screws, which are not shown in the illustration. The small figure to the right shows a small disk, made either of brass or copper, which is cabable of sliding down the suspension clamp by means of the two loops shown. The actual mirror is fixed on this copper disk by means of any kind of cement, such as Chatterton's compound. This disk has the advantage of gripping the mirror round the edge, which prevents the common accident of the mirror becoming detached, leaving part of the silvered surface stuck to the support.

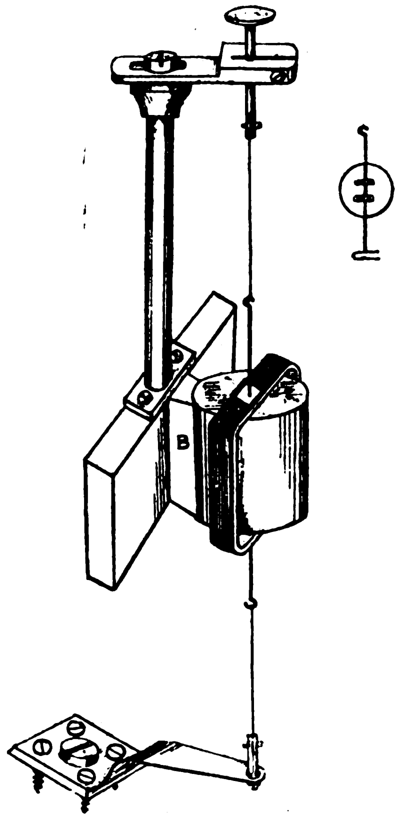

Fig. 9.

The above class of instrument in a great variety of forms is now being passed into general use in the way of ammeters and voltmeters, extra resistance being added to them in the latter case, whilst the greater part of the current is shunted in the former instance, so that only from one-tenth to one ten-thousandth passes through the coil, which in portable instruments is suspended between pivots.

REQUIREMENTS OF ELECTRICITY IN MANUFACTURING WORK.*

BY WM. S. ALDRICH.

(*Concluded from page 349.*)

VII. APPLICATION OF THE ELECTRIC DRIVE.

1. Individual Driving without Intermediate Gearing: The armature of the motor is mounted on the main spindle of the machine. The power is most directly applied, with ideal adaptation of tool to work.

It requires more or less special adaptation of motor to machine, with rarely any marked changes in the structural design of the latter.

2. Individual Driving with Intermediate Gearing: The motor is conveniently mounted on the frame of the machine and drives it through the intervention of the ordinary gearing.

It requires no special adaptation of motor to machine. Any suitable motor may be used on any machine.

3. Advantages of the Individual Drive: The workman has the most perfect control of all factors entering into the economies of production. There is maximum economy in the application of power.

The speed control and the output are independent of any other machine. They are no longer limited by the speed of the line shafting. Machines and tools may now be worked to the limits of their respective capacities.

The productive efficiency of the machine is increased. It may be operated at all times up to the power limit, reducing time and cost of labor for any given product.

The choice of the individual drive depends upon the power required, the size of the machine, the time it is in service, and the value of the product.

The individual motor drive is usually adopted where the machine is in use only part of the time, and in sizes only two or three horsepower, and requiring wide variations in speed and power for maximum output quite independent of the first cost. For large machines this method reduces the power losses to a minimum. It is particularly advantageous for shears, punches, and a class of repair-shop tools requiring power only at intervals. The constructive details and design of direct-driven machines are not usually altered to any extent; secondary speed changes are obtained by the usual chain-gear and mechanism; in special cases of large tools, a range of speeds is sometimes provided by a special variable-speed motor.

4. Group Driving: A few large electric

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*Paper presented at the Milwaukee meeting, May, 1901 of the American Society of Mechanical Engineers.

motors are employed independently, driving sections of shafting of most economical length. This method is thus adapted for driving a number of small machines, with no particular requirements in speed or in power; or for most economical manufacturing along special lines; or for driving any section on overtime or night shifts; or for independent driving of separate floors, departments, or detached buildings.

The maximum economy with the group system can only be secured when all of the machines so driven are in constant use, at best speeds for maximum output. This dictates grouping machines, as far as practicable, of the same size, style, functions, speed and power requirements, having due regard to the work to be executed. Sectionalizing the power transmission by substituting electric motors for either the main or section belts secures partial advantages of the new system side by side with the old, and is frequently resorted to in old establishments adopting new methods.

5. Individual and Group Driving: The most general requirements of factory transmission can all be met by an intelligent combination of these two methods of electric driving.

The first cost of installing the individual drive will generally be from 2 to 5 per cent. higher than for the best group system, when all other considerations are the same. The individual drive is more economical in the use of power than the group system. especially if in the latter only a limited number of grouped machines are in use at any one time, under average loads.

6. Portable Tools and Appliances: The extreme flexibility of the electric system invites the widest use of portable tools and appliances. A flexible, heavily armored cable gives any desirable radius of action, with no expense to maintain as a part of the transmission system, with no danger or difficulty in handling, and requiring least time and labor for any immediate shifting of tool or work. Least used tools need not occupy floor space when not in operation. Most favorable economic relations, may, therefore, be secured in many lines of manufacturing work, especially of the heavier grades. Almost all required tools may be taken to and operated at the work in hand. Time is saved in not having to shift and adjust the work to the machine or tool. Several operations may be carried on at one time by bringing different tools to the work, each independently driven and operated.

7. Electric Transportation and Conveying: Electric hauling by surface or overhead systems of distribution, electric conveying and telpher systems, electric cranes, hoists, lifts, and elevators, are all well-developed fields, and present no unusual nor insurmountable difficulties when installed as a part of the regular electric system of a manufacturing establishment. Tools are taken to the work, or machines and tools are quickly served with material and work, reducing the cost of all handling to the lowest terms in a field of non-productive labor that has formerly been very expensive.

8. Electric-Driven Auxiliaries: With an established electric supply service for all manufacturing work it is an economic step to drive by electricity all auxiliaries, as pumps, fans, blowers, air compressors, etc.

VIII. SELECTION OF EQUIPMENT.

1. Factors Determining Choice of the Electric System: Each manufacturing industry has its own inherent requirements. No general rules can be given, but every case must of necessity be studied and developed by itself with a thorough preliminary survey of all conditions and requirements. One successful system cannot furnish precedent for another.

In general, the following lines of inquiry should be freely investigated before choosing any system for power transmission in manufacturing work; the size of the establishment; the area to be served; the arrangement and grouping of shops, departments, or buildings; the arrangement, types, and sizes of machines or tools to be driven; the variety of speeds required; the character of the loads involved; the kind of work to be executed; the economies of fuel and water supplies.

The above items should have been predetermined from the standpoint of most economic production. They should in no wise be influenced by questions of power transmission.

How to drive the machinery in a new and modern manufacturing plant should be a second and not a first consideration. It should be determined by, rather than itself determine, the conditions for economic production.

2. Interchangeability Throughout the Electric System: It should be possible to drive similar apparatus and motors from any point of attachment to the wiring system. Greater flexibility is thereby secured, added facilities provided for use of portable tools, and readiest extension made of plant and distributing system at any time. Preferably have one, and only one, electric system if it can be secured by intelligent consideration of all present and the most probable future requirements. This does not necessarily imply that it is best to have one single circuit for all kinds of service required in a manufacturing establishment, as light and power; but it should not be required to use different circuits for the same service, as portable tools.

3, Uniformity of Electrical Equipment: Generating sets and motor equipments should be standardized as far as possible in the case of any given establishment. These machines, as well as all their parts, should be readily obtained in duplicate at any time. This is particularly important in making additions and extensions in the group system, where it may be required to change from a smaller to a larger motor at any time to accommodate more machines on a given section. It cannot be advantageous to experiment with different styles and types. Electrical machinery to-day is so far standardized, and its performance predetermined, that there can be no excuse for not selecting that style and type best adapted to any given factory.

4. Power Required as a Basis for Size of Electric Motor: The load diagram for any machine will furnish the best data for determining the proper size of motor. It may be readily obtained under the working conditions of the machine by using a test motor.

In almost all metal-working industries the power required is subject to extreme fluctuations, and may be very heavy, at times, while the bulk of it will be quite light. It is not necessary to install an electric motor to carry, for any length of time, such sudden and heavy loads as will be shown by the peaks of the load diagrams for the several machines, or the sudden initial throw of the ammeter needle.

The limit of overload is fixed by the allowable rise of temperature, and can readily be predetermined for any given electric motor. In general, the surface temperature of the motor field coils, as measured by a thermometer, should not exceed from 35 to 45 degrees C., with a maximum limit of 50 degrees C., after an overload run of from six to eighteen hours, as may be specified by the builders.

Starting-load currents are of course high, and may be from two to three times the normal current, as in the case of overloads for brief periods. Individual drives require proportionately larger motors to enable them to carry alone the heavy overloads. Group drives require only normal load motors, as it will rarely ever occur that the several grouped machines are all carrying overloads at the same instant. Motors for this service may often be much smaller than would be dictated by the combined load diagram of the machines forming the given group or section. In no case will they require to approach the maximum, or the sum of the maximum, loads of the various machines. Group system load curves will be smoothed out considerably. In all electric motor installations there should be ample power provided, rather than a narrow margin only to work upon. Increasing loads are almost sure to arise in time. A motor of ample size gives that reserve power so characteristic of the electric system, if properly installed.

5. Character of Loads in Manufacturing Work: Load curves and diagrams of individual machines, groups, sections, and the entire plant only can be relied upon in estimating the character of loads being carried or likely to be carried under similar conditions. The load factor—the ratio of the average to the maximum load—for any given time on any part of the system, should be as high as possible for best working efficiency and economy. It may be largely influenced by the way the operator handles his motor. Whatever the kind of load—uniform or variable, light or heavy, continuous or intermittent, suddenly fluctuating or periodically variable—it must be carefully investigated before installing electric motive power. In certain instances flywheels may be useful and for the same mechanical reasons as elsewhere employed in machinery.

6. Speeds of Manufacturing Machinery: The speeds should be predetermined by the conditions for most economic maximum output, and so fix the range required for the electric motors. In no instance should the reverse be the case. In many cases of individual drives it may be best to secure the speed reductions mechanically, as by the ordinary change-gear. It is not necessary nor advisable in all cases to secure the same by mounting the motor armature directly on the spindle of the machine. Provide motors with speeds consistent with the range of chain-gear, and gear down rather than up.

7. Electric Generators Required in Manufacturing Plants: The style and type should be largely determined by the kind of service to be supplied, the size by the normal and overload conditions as shown by the plant-load diagrams, with due considerations given to special conditions and variable loads.

The actual normal capacity of the generator will be chiefly determined by the length of time the various motors are in use, rather than by their normal or aggregate capacity. It may happen, owing to the intermittent use of machines and motors, that the generating plant may be reduced to 50 per cent., or even to 20 per cent. of the aggregate normal capacity of the motors out in the establishment. An increase of the electrical system can only be intelligently made from a careful study of the load curves of the existing installation, and using it as a basis for comparison with the probable load curve under the proposed conditions. There should be judicious subdivision of the generating plant into units, preferably of the same size and style, that they may be readily interchanged and duplicated at any time, with one or two relay units for emergencies and extra rush seasons of work. All generating units used in manufacturing installations will necessarily be of such size as to warrant their being driven by direct connection to engines or turbines. If generators required are too small to warrant direct connection, the establishment is too small to warrant an introduction of the electric drive.

8. The Electric Wiring and Distributing System: All wiring should be done in accordance with the "National Electric Code," being the rules and requirements of the National Board of Fire Underwriters. Separate service circuits, from the same or separate bus bars, may be provided to advantage, for lighting and various power uses. Sub stations or substation switchboards, should be provided for separate shops, floors, departments, or buildings, making it unnecessary to run a separate set of wires back to main switchboard for each service.

9. Indirect Electric Distribution: Indirect distribution, through the use of accumulators, converters or transformers may be found expedient under certain conditions. For the three-wire systems, some type of accumulator or motor generator balancing set is almost essential for efficient regulation. The accumulator may render as invaluable service in certain kinds of factory installations, as in iron and steel mills, as it is now rendering traction work, where the character of the load variations of the former is somewhat analogous to that of the latter. The loss in the battery is very small and entirely negligible compared to the advantages to be derived from its use in manufacturing plants of the type mentioned.

IX. LOSSES IN FACTORY TRANSMISSION.

The inherent losses common to all systems of factory transmission are due to the intermittent and irregular use of the machines driven. These are reduced to a minimum with the electric drive. There is no consumption of power when the motor and machine are not in operation. There are no power losses when the motor is not in use, no so-called dead load losses, due to mechanical friction of the shafting system, no transmission losses in the line when the electric current is not required.

Electric generators and motors, when in operation at uniform speeds, have, generally speaking, but two kinds of losses. The first is a constant quantity depending upon the size and type of machine; the second is a variable loss proportional to the square of the current in the armature circuit. The electric line and other wiring has a loss proportional to the square of the current carried. The cost of waste power in the mechanical system becomes excessive at light and frictional loads. It is saved in the electric system, in which the constant losses are minimized and the variable losses are throughout proportional to the amount of work being done.

X. EFFICIENCY OF ELECTRIC TRANSMISSION.

The efficiency of the electric system under normal conditions shows high maintained values, from about 25 to 35 per cent. underload to the same amount of overload, for the individual generators and motors, as well as for the aggregate efficiency of the installation. In mechanical transmission there is a constant falling off in efficiency at various underloads in every part of the system, owing to the inherent losses due to mechanical friction, which losses are constant at all loads and constant speeds. It is not a question so much of the individual efficiencies, in either case, as of the aggregate or combined efficiency from engine or turbine shaft to machine or tool.

The performance should be considered and compared at proportional parts of the full load as well as at normal loads. The mechanical efficiency of all manufacturing machines is almost invariably low. It is possible materially to effect it by efficient motors properly selected, installed and operated.

The all-day efficiency may be made higher with the electric drive than with any other system, as the amount of time is minimized during which machines and tools are necessarily idle.

XI. OPERATION AND TESTING OF FACTORY INSTALLATIONS.

1. The Generating Plant: As far as practicable, each unit should be operated at its normal capacity—additional units to be switched in as may be required by the manufacturing conditions.

2. The Motors: Rarely the case that any machine or tool is started from rest with full load upon it. Motors may be started best under the usual friction, or light loads on the machines, as in the belt systems. When the machine is brought up to proper speed, work may be thrown on to it. In this respect the practical operation of an individual electric drive follows closely that of the belt system.

It is always possible to tell exactly what is going on in an electric drive, both in kind and amount of useful work, as well as in matter of wastes and losses. Power measurements are made at any point by ammeter and voltmeter, or by a wattmeter alone. A special test motor of known performance lends itself admirably to comparative tests of the performance of machines and tools under various conditions. Workmen may know at any moment whether they are driving tools or machine to best advantage for maximum output at best speeds.

The definite power required for definite work may be determined and charged to each machine, tool, or piece of work, and so make up the shop cost of production more exactly than by any other system. The power lost in friction of individual machines when running empty may be obtained with equal facility and compared with that required in doing useful work. It will be found that the latter increases almost directly as the resistance being overcome by the machine in its operation under working conditions. The power required by the work is a small per cent. of the total power delivered to the machine.

Electricity Supply in Germany.

"Elektrotechnische Zeitschrift" has just published its annual table of statistics relating to the electricity supply works in Germany. These statistics, says the "Electrical Engineer," London, represent the state of things up to April 1 last, and show that on that date there were 768 electricity supply works in operation in that country, as compared with 652 works in the preceding year. On an average the expenditure has been at the rate of just over £80 per kilowatt of generating plant installed, while the total capital expenditure on electricity supply works, exclusive of tramways, in Germany has been about £27,000,000. The number of works generating nothing but continuous current on April 1 was 81.3 per cent., as compared with 80.4 per cent. the previous year. However, this only represents 43.8 per cent. of the total kilowatt capacity of all the works, a decrease of 3.6 per cent. since last year. This is explained by the fact that there is a large number of small works with outputs below 100 kw. supplying continuous current, while the larger works usually lie at a distance from the supply areas, and generate three-phase or single-phase current, which is led to the sub stations. The number of three-phase continuous-current systems has increased from 38 to 43 (41,757 kw. to 86,985 kw.), and the number of combined single-phase current systems from 6 to 10 (1,599 kw. to 6,874 kw.) Purely three-phase works have increased from 39 to 45 (35,150 kw. to 40,759 kw.), and of works employing nothing but single or two-phase currents the number has increased from 42 to 44 (21,570 kw. to 27,547 kw.). In two works, with an aggregate capacity of 950 kw., mono-cyclic generators are employed. Nearly all the continuous-current stations are equipped with batteries, only 24, or 33.8 per cent. of the whole, being without them. It is calculated that the average capacity of the accumulators in use is 36.2 per cent. of the capacity of the generators in the works in which they have been erected. Of the total 768 works, 56.4 per cent. have a smaller capacity than 100 kw., and there are in all 38 works with capacities of over 2,000 kw. The connections to the mains of all the stations represent an aggregate of about 352,500 kw., an increase of 28.8 per cent, over last year. The largest of the works now in operation in Germany is the huge water-power station at Rheinfelden, the capacity of whose generators is 12,000 kw., and next in order comes the Oberspree station, near Berlin, with a capacity of 10,770 kw , both these figures being exclusive of sub-station equipment. At the present time there are 90 additional works either contemplated or being erected.

LONDON NOTES.

[From our London Correspondent.]

Electric Underground "Tube" Railways.

The announcement made this week to the effect that the Board of Trade through its arbitrators has declared the continuous current system the right thing for the "Underground" Metropolitan District lines, has not come as a surprise to electrical engineers here, especially those who had the privilege of following the evidence personally in the court or who read it in the technical press. The pretty general opinion seems to be that these two railway companies are in too unsatisfactory a financial position for it to be reasonable that they should take in hand anything approaching to an experiment. The arbitrator declares the Ganz system to be, at any rate so far, nothing more than this, and his only reasonable conclusion was that the direct current system which has shown its capabilities on many lines is the best applicable at any rate to these particular railways. In time, however, as most engineers believe, the polyphase system will play a very important part in electric railway working, but that time does not appear to be quite yet. For immediate practical purposes, however, it has not yet commended itself, and Mr. Yerkes has been victorious all along the line. It is also pretty certain that the decision in this case will weigh with other lines which are shortly to go in for electrical working.

We may mention here that the Parliamentary notices which have been lodged by would-be promoters of new electrical undertakings contain quite a big bunch of underground electric lines on the "tube" principle. Lines are projected to run across London in almost every conceivable direction, and some of them clash to some extent. Manchester also has its circular tube electric project coming forward.

The Northwestern Electrical Association.

The tenth annual convention of the Northwestern Electrical Association will be held at Milwaukee, Wis., commencing on Wednesday morning, January 15 next. Reports and papers on subjects of special interest to central station men will be read and discussed. An attractive entertainment programme is being arranged, and a pleasant and profitable time is assured to all who attend the convention. The Association extends a cordial invitation to all who are interested in electrical matters.

LEGAL NOTE.

Judge Coxe of the United States Circuit Court, sitting in Utica, N. Y., December 20, filed an opinion in the case of the Electric Storage Battery Company against the National Battery Company, the American Bicycle Company, and Eugene W. Belknap, a user. In his opinion he sustains the validity of the Electric Storage Battery Company's Brush patent and enjoins the National Battery Company from the further manufacture and sale of storage batteries and from the further manufacture and sale of the Waverly electric vehicles equipped with infringing batteries, and enjoins Belknap from the further use of the Waverly electric vehicle.

The McKinley Memorial.

Col. Allan C. Bakewell, of the Sprague Electric Company, representative of the electrical industry for the McKinley Memorial Association, has received and gives out the following letter from Mr. Cornelius N. Bliss: A happy solution of the confusion resulting from two associations appealing for popular subscriptions at the same time for the McKinley Memorial was arrived at by a conference held in Washington between committees of the McKinley National Memorial Association and the Washington Memorial Arch Association. The latter decided to withdraw its application for popular subscriptions, leaving the field entirely to the National Association to make provision for the memorial at Canton, and it was mutually concluded to ask Congress to make such provision for a memorial at Washington as should be thought fit and proper by that body. This leaves the field of popular subscription entirely free for the Association with which you are connected, and we trust that prompt and active measures may be taken by all the committees of this association to conclude the work in this State at the earliest possible moment.

PERSONAL MENTION.

Mr. H. W. Webb of Baltimore has been appointed general manager of the Maryland Telephone and Telegraph Company, vice S. H. Browne, who formerly occupied the position of general manager and chief engineer.

Mr. U. N. Bethell of this city has been elected president of the Chesapeake and Potomac Telephone Company at Washington, D. C., to fill the vacancy caused by the death of Mr. Jeremiah M. Wilson.

INCORPORATIONS.

The Citizens' Electric Light & Power Company, Princeton, Wis. Capital stock, $7,500. Incorporators: H. K. Priest, E. A. Zierne, E. D. Morse, O. H. Lichtenberg, Gustav Teske and J. E. Linner.

The Franconia Electric Company, Franconia, N. H. Capital stock, $250,000.

The Home Electrical & Telephone Company, Kansas City, Kan.—to put up a $1.000 electric light plant and a telephone system. Capital stock, $1.000. Incorporators: W. L. Wood, J. O. Fife, J. J. Smalley, J. F. Getty and H. S. Swingley, all of Kansas City.

The Phoenix Gas & Electric Fixture Manufacturing Company, St. Louis, Mo. Capital stock, $15,000 Shareholders: A. D. Gratian, Charles M. Wempner, Maurice W. Koenigsberg and Frank X. Chassaing.

The Western Lighting & Electric Company, Milwaukee, Wis.—to supply electric machinery, light and power. Capital stock. $25,000. Incorporators Jesse Coogan, Charles H. Forrestal and W. H. McCoy.

The Charles G. Hose Electric Company, New York City. Capital stock, $800 Directors: C. G. Hose, Major Irwin and H. G. Hose, of Brooklyn.

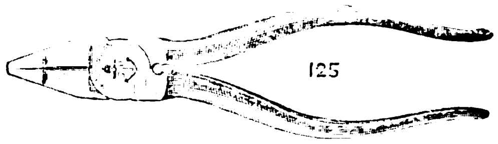
The American Cycle Manufacturing Company, Trenton, N. J.—to manufacture and sell bicycles and automobiles. Capital stock, $8,000,000. Incorporators: Joseph E. Bromley, R. Lindsay Coleman, George Pope and Thomas E. Merseles, all of Jersey City.

The Ritter Electrical Company, Cincinnati, O. Capital stock, $15,000. Incorporators: William F. Ritter, Joseph Grumsley, Wing A. Ackley, Adelbert Butz and John N. Ritter.

A First Class Tool for Electricians and Linemen.

A first class tool for electrical work, such as telephone, telegraph or any work where side cutting plyers, of a grade quality are required, was shown us this week by the Smith & Hemenway Company and the Utica Drop Forge & Tool Company of 296 Broadway, New York City.

It is a Swedish Side Cutting and Splicing Plyer, No. 125. It is made from the celebrated Swedish Electro Borasic Steel, which has been tested for years, and found to be everything that is necessary to make a first class article that will stand cutting the hardest kind of steel and iron wire without affecting the cutting edge.



It has their patent round edge, which is a great advantage, as it can be carried in the pocket without wearing or tearing the clothes. It is also very desirable where they are liable to drop the plyers on the wire where they are working. Square edges will invariably break the scale, thereby injuring the conductivity of the wire, while the patent round edge will not. It is absolutely necessary for copper wire work. It has polished head and jaws and comes finished in either half polished, polished, or nickeled. It comes in six different sizes.

These companies are the publishers of a very unique catalogue, known as the Green Book of Hardware Specialties, which will be sent to anyone writing for same. When writing please mention 125.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DEC. 17, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

688,828. Speed Regulating Device for Overhead Electric Carriers. Arthur S. Clift, East Orange, N. J. Filed April 19, 1901.

688,869. Mechanism for Raising Contact-Shoes on Third-Rail Systems. Sam H. Libby, Schenectady, N.Y., assignor to the General Electric Company of New York. Filed Aug. 24, 1897.

688,922. Electric Railway. Robert Bingham, West Haddonfield, N. J., and Charles Schlechtiger, Nantasket, Mass. Filed Aug. 22, 1901.

688,962. Fender for Vehicles. William A. McGuire, Chicago, Ill. Filed Feb. 1, 1901.

688,964. Quadruple Relay Crossing Signal. Bert N. Parrish, Jackson, Mich. Filed Aug. 1, 1900.

689,227. Trolley-Catcher. Charles B. Robertson, Ottumwa, Ia. Filed March 5, 1901.

689,328. Trolley. Thomas McWilliams, Kings Park, N. Y., assignor, by direct and mesne assignments, of one-half to John H. Lutz, Bath Beach, Brooklyn, N. Y., and Harris Henschel, Kings Park, N. Y. Filed March 6, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

689,356 Electric Arc Lamp. Charles Eschwei, New York City, assignor of one-half to Morris Duklauer, Mount Vernon, N. Y. Filed March 27, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

688,873. Electric Mining Machine. Edmund C. Morgan, Chicago, Ill., aassignor to the Morgan Electric Machine Company, same place. Filed June 10, 1901.

688,891. Semaphore Operating Device. Judson Shoecraft, Eskridge, Kan., assignor, by direct and mesne assignments, of one-half to Warren Marshall and George Skinner, same place. Filed May 31, 1901.

688,982. Automatic Electric Switch. Arthur H. Adams, London. Eng. Filed April 22, 1901.

689,128. Automatic Electromagnetic Time Switch. Joseph Sachs, Hartford, Conn. Filed Sept. 27, 1900.

689,130. Alternating-Current Meter. Karl O. F. Schrottke, Berlin, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Sept. 2, 1899.

689,370. Power-Transmitting Mechanism. Mayer Slotkin, New York City, assignor of one-half to Julius Praglin, same place. Filed June 19, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

688,970. Fire Protector for Telephone Cables. Frank D. Saylor, St. Louis, Mo. Filed May 13, 1901.

MISCELLANEOUS.

688,813. Composition of Matter as a Non-Conductor of Electricity. Jose M. Ancira, New York City. Filed July 26, 1901.

688,855. Earth Conductor for Lightning-Conductors. Paul Immich, Charlottenburg, Germany. Filed Oct. 7, 1901.

688,861. Electric Furnace. Charles A. Keller, Paris, France. Filed Dec. 3, 1900.

688,886. Incased Electric Time-Alarm. Alexander P. Schloss, New York City. Filed Feb. 11, 1901.

688,915. Induction Coil. David H. Wilson, Chicago, Ill. Filed March 28, 1901.

688,919. Electrostatic Instrument. George L. Addenbrooke, Westminster, London, Eng. Filed June 10, 1901.

688,995. Electric Heater. Edward E. Gold, New York City, Filed Aug. 19, 1898.

689,093. Electrical Apparatus. Thomas B. Kinraide, Boston, Mass. Filed May 4, 1901.

689,133. Electric Lock. Hermann Seewald, Possneck, Germany. Filed April 24, 1901.

689,138. Cover for Interior Electric Conduit Boxes. John H. Stahley, New York City. Filed Sept. 20, 1901.

689,139. Interior Electric Conduit Box. John H. Stahley, New York City. Filed Oct. 30, 1901.

689,171. Insulator. John F. Duffy and Henry B. Hershey, Scranton, Pa. Filed June 12. 1901.

689,199. Electrode. Thomas B. Kinraide, Boston, Mass. Filed May 2, 1901.

689,218. Electrical Insulator. Albert F. Parks, Brooklyn, N. Y., assignor to Lewis B. Stillwell, New York City. Filed April 8, 1901.

689,253. Method of Locating Faults in Electrical Circuits. Thomas W. Varley, New York City. Filed March 30, 1901.

689,254. Apparatus for Locating Faults in Electric Circuits. Thomas W. Varley, New York City. Filed March 30, 1901.

689,278. Electric-Conduit Terminal. William F. Bossert, Utica, N. Y. Filed June 4, 1901.

689,335. Junction-Box for Electrical Conduits. Robert M. Thomas, New York City, assignor to Thomas & Betts, same place. Filed June 20, 1901.

689,353. Protective Mechanism for Systems of Electrical Distribution. Robert V. Cheatham, Louisville, Ky., assignor of one-half to Joseph A. Stewart, same place. Filed May 23, 1901.

THE TELEPHONE WORLD.

Rival to the Bell Telephone Company in Buffalo.

The Bell Telephone Company will now have a competitor in Buffalo, N. Y. Martin Carey, representing the Frontier Telephone Company, said recently that his company would accept the franchise from the city that was signed by Mayor Diehl, who said he signed the franchise simply because it seemed to be the desire of the majority of the people of that city that there should be competition in the telephone business. The work of installing the new system will be begun as soon as the necessary contracts are made and papers signed.

An Automatic Telephone Monitor.

J. B. Lee, manager of the Southern Telephone Company, at Waycross, Ga., has received letters patent on "automatic monitors for telephone exchanges." This was invented by Mr. Lee last year. It is intended to record the length of time taken by operators in answering the calls for subscribers.

The telephone companies of Knoxville, Tenn., are making extensive improvements in their local exchanges and the system in that city. The East Tennessee Company is expending many thousands of dollars in improving the equipment of the local exchange with a view to still further improving the already fine local service. A new switchboard is to be installed in a short time. Besides expending a great deal in local improvements the management of the East Tennessee Company is also paying special attention to its large toll line system, radiating from Knoxville. The toll line business appears to be growing fully as rapidly as the local exchange system and connections are being made almost every week with a number of important near towns and toll stations. The work of installing the switchboard in the new exchange building of the People's Telephone Company has been in progress in connection with the building and wiring of the underground conduit system for over three months. The wires are now being connected with the new Ericsson switchboard.

Cowley County, Kan., is probably the first county of that State to have a telephone system organized primarily for the benefit of the rural residents. The Morgan Rural Telephone Company is the new organization which will have its headquarters at Atlanta, and will operate in Cowley and Butler Counties. J. T. Morgan, the organizer and promoter, lives at Wendell, Butler Connty, and expects to build up a system which will reach many of the localities in that and adjoining counties, where there are now no connections. The first line to be built will be from Leon to Winfield. It will connect at Winfield with the independent company's exchange and all its toll connections.

The Sinepuxent Telephone Company, operating between Berlin and Snow Hill, Md., was granted a conditional franchise by the Snow Hill city council a short time ago. The conditions surrounding the charter are that if the Worcester Telephone Company, which is operated by the Diamond State Company, does not grant a free exchange of messages of the Sinepuxent Company then the latter will be allowed to erect poles in the town and maintain an independent line in Snow Hill. This action of the city council is considered a safeguard to the business interests of Snow Hill.

A telephone line has been completed from Pellyton to Dunnville, Ky., where it connects with the Hustonville and Green River Valley lines. A line is in course of erection from Pellyton to Rolla, and when completed Middleburg will be in telephonic communication with all Southern Kentucky points of note.

The Hancock Telephone Company, Hawesville, Ky., owned by W. C. Ford, and I. C. Adair, of Fordville, was sold lately to the Southern Telegraph Company, whose headquarters are at Nashville, Tenn. This sale will result in a break of the proposed line to Louisville.

John W. Moore, a farmer of Wyandotte Township, Kan., obtained from the county commissioners authority to string telephone wires across the Turner Bridge. He represented a company of farmers which is putting in a private telephone system in that part of the county.

About a year ago the town of Neepawa, Manitoba, bought out the electric light plant and put in a telephone service in connection with it. The telephone rates in that town are $20 a year for business places and $10 for private houses.

The Union Telephone Company of Fairview, O., has increased its capital stock from $10,000 to $25,000.

A telephone system has been established at Eau Gallie, Fla.

New Independent Telephone Combine.

From an authoritative source in Minneapolis. Minn., it was learned last week that the owners of the independent telephone lines in Wisconsin, Minnesota and Northern Michigan will unite to form a long-distance toll line service in the Northwest, to compete with the Erie system in that section.

It is said that the Milwaukee Telephone & Telegraph Company, which is now seeking a franchise in Milwaukee, is a part of the proposed new company. It is also rumored, although denied by President Moulton, that the Twin City and the Rapid Service Companies of Minneapolis, are to be included in the amalgamation. Every independent line in Wisconsin and Northern Michigan is said to be interested in the merger.

There will be a meeting of the owners of the independent lines at Milwaukee in February, at which the matter will be thorougly discussed and the organization perfected.

The Allegheny County, Pa., Telephone Company, a subsidiary company of the Pittsburg & Allegheny Telephone Company, has completed the installation of a new exchange at Braddock. It is the largest telephone exchange of any concern in the Monongahela, Turtle Creek or Youghiogheny valleys. The new plant includes the latest devices, and was built by the Kellogg Switchboard Company of Chicago. The Pittsburg & Allegheny, which controls the Braddock and Homestead exchanges of the old Allegheny County Company, has been renewing all the wire that was strung by the last-named company. New cables will take the place of single wires, stretching from the exchanges to all the streets. The wires will be placed in the cables. The cost of making the change from single wire connection to that of cables and replacing the old style "bell ringing" telephones with the new self-ringing "central energy" light producing telephones when a call is made, upon the operator's board, will reach $25,000. This includes all the subscribers in Braddock, North Braddock, Rankin, Hawkins, Munhall, Homestead and West Homestead borough. In the Braddock district there are 650 subscribers, and in the Homestead district 450 subscribers. The new exchange at Braddock has a capacity for 1,440 subscribers.

Some time during the month of January the Twin City Telephone Company of St. Paul, Minn., will move from its present offices in the Phoenix Building to its new home on the northeast corner of Eighth and Cedar streets, where the new building is rapidly nearing completion. When completed the building will be one of the finest of its kind in the United States, and every convenience that is known in the telephone business will be used, and every device that is calculated to expedite conversation at a distance will be at the service of the patrons of the company. Since April the Twin City Telephone Company has expended over $500,000 in construction work. It now has 6,000 subscribers in St. Paul and Minneapolis, and handles from 25,000 to 30,000 calls each day. The management expects within the next six months to handle 100,000 calls every twenty-four hours. This company has demonstrated that expense was no object in consideration with efficiency.

Telephone service in some of the smaller towns in Connecticut will cost less after the 1st of January than at the present time. One year ago the Southern New England Telephone Company reduced the rates in a number of the smaller towns. Beginning on January 1 the present rates for the service in Torrington will be reduced from $24 per year for residences to $18 and for business houses $24 from $36. This rate is for party wire service.

The Oliver, Ga., Telephone Company will soon have the new line complete from Halcyondale to Oliver, and will be extended to Hugginsville at once. This will give the public a 'phone accommodation to Sylvania, Girard, Waynesboro, and many other points on the line.

In the Circuit Court at Lawrenceburg, Ky., judgment was recently entered in favor of L. H. Carter, trustee, etc., against the Anderson County Telephone Company, and the plant was ordered to be sold for the debt.

The Macon Telephone Company has reached Perry, Ga., with its long-distance 'phone. It enters Perry via Kathleen, and will be extended to Eastman via Hawkinsville and Cochran.

The Spottsylvania Telephone Company has made a deal with the Louisa Telephone Company by which the Spottsylvania Company will obtain control of the line from Belmont to Tinders, Va., on January 1.

The Chillicothe & McArthur Telephone Company has completed its new metallic lines to Zaleski, O.

Prospects for New Telephone Exchanges.

The business of the Citizens' Telephone Company of Columbus, O., has increased to such an extent that it has been found necessary to put in sub-exchanges for the purpose of facilitating matters and rendering the service more efficient.

The engineers of the company are now engaged upon the plans for the sub-exchanges and there may be one for the North Side and another for the East Side of that city. The exchanges will provide for about 3,000 subscribers and will give the relief needed at the main office. Unless more floor space can be obtained at the present building, the new exchanges will be constructed immediately. They will be installed in buildings to be erected by the company.

A telephone rate war will be opened as soon as the new trunk line between Camden and Atlantic City, N. J., carrying 12 wires, is completed. Louis Kuehnle, president of the Atlantic Coast Telephone Company, of the last-named city, states that it will not be in the nature of a reduction in price, but that it will come in the extension of the time a person will be allowed to talk over the wires. At present the rate for a three-minute talk to Philadelphia is 40 cents. The new company will allow five minutes' conversation for the same charge, and if the Bell Telephone Company meets the cut then the new company will make it 10 minutes. In fact, free service between there and the Delaware may be given regular subscribers.

The farmers south of Ames, Ia., are going to have telephones. Some time ago the farmers near Slater, and later near Huxley and Kelley, formed small independent companies, each having about 14 or 16 'phones. Single lines carrying these 14 'phones were run into the towns, and in this way three or four lines were run out of each town, connected by switchboards. One line south of Ames runs straight east from Kelley, and it is proposed to run a line nine miles long from Ames connecting with this line by a switchboard.

A report from Cincinnati, O., states that the telephone company has adopted a new system of nickel-in-the-slot telephones for private residences, to eliminate the free use of telephones by neighbors of persons having them. Their use is not required by the company, but persons who want a telephone at reduced rates can put in one of the new design by guaranteeing 600 calls a year. Any deficiency in the number of nickels must be made up by the renter.

The line between Laurel and Delmar, Del., connecting the parent Diamond State Telephone Company with the Salisbury and other Eastern Shore lines, has been completed, There is now a network of wires connecting all peninsular towns of Delaware, Maryland and Virginia.

It is stated that the Blackstone Telephone Company, which is putting in an up-to-date telephone system at Richmond, Va., with a central office, is fast pushing its work to completion, and will soon have the 'phones working.

Fred M. Wilcox, owner of a 6,000 acre ranch in Milford Township, S D., is planning to establish telephonic connection between the ranch and Huron. Farmers along the line will also use the 'phone.

The Farmers' Telephone Supply Company of Milwaukee, Wis., has filed an amendment to its articles, decreasing its capital stock from $500,000 to $50,000.

The local telephone company of Newark, N. J., has extended its line to Milford. The towns of Everittstown and Mt. Pleasant, will shortly be connected.

An amended charter of the Fluvanna Telegraph & Telephone Company was recorded in the office of the Secretary of the Commonwealth at Richmond, Va., last week.

There is much comment upon the prospect of a new telephone system in Eminence, Ky.

The Texas Telephone Company of Abilene has increasd its capital stock from $6,000 to $12,000.

The telephone line from Clarendon to Holley, N. Y., is now completed.

The Martinsville, Ill., Telephone Company has dissolved.

TELEPHONE INCORPORATIONS.

The Ithaca Telephone Company, Ithaca, N. Y.—to operate in Ithaca and other places in Tompkins County. Capital stock, $75,000.

The Ontonagon County Telephone Company, Ontonagon, Mich. Capital stock, $25,000.

GENERAL ELECTRICAL NEWS.

Lighting.

Alton, Ill.—This city is to have another electric lighting plant, and the Kinloch Company of Missouri, it is said, will establish it.

Assumption, Ill.—The village board at its last meeting granted a franchise to a new company for the purpose of conducting a general electric lighting and power plant.

Benton Harbor, Mich.—Frank English of this city appeared before the village council of Coloma and declared his desire to install an electric lighting plant there. The franchise was granted.

Bluffton, Ind.—H. D. Cook, a wealthy grocer, will ask the city council to grant him a franchise for an incandescent lighting system.

Cranbury, N. J.—This place is to have electric lights. The Improvement Society and the township committee have gotten together and it is likely a contract will be placed with the Princeton Electric Light & Power Company.

Cripple Creek, Col.—At a recent meeting of the city council the finance committee was instructed to investigate the proposition of the construction of a city electric light plant, which would be owned by the municipality.

Elreno, Okla.—A franchise has been granted to John A. Newton of this place, Geo. B. Loving and John M. Scott of Fort Worth, Tex., for the erection of an electric light plant.

Essexville, Mich.—The citizens of this place are expecting to light the village with electricity in the near future.

Fayette, Miss.—The citizens have voted to issue bonds for waterworks and an electric light plant.

Grand Rapids, Mich.—A $200,000 stock company has been organized here, and will soon be incorporated to furnish electric power and light and hot water heating.

Herington, Kan.—The people of this place are talking of putting in an electric light plant.

Hiawatha, Kan.—The electric light plant at this place was partly burned a short time ago.

Iron Mountain, Mich.—At a public meeting held here it was declared by a unanimous vote that the city should erect and operate a lighting plant. The matter will be submitted to the people at the spring election.

Marshall, Mo.—At the special election held at this place the question to bond Saline County for $70,000 for the purpose of establishing waterworks and a light plant was carried.

Mexico, Mo.—The city council has submitted to the voters a proposition looking to the municipal ownership of the electric light plant. The sum is not to exceed $25,000.

New Martinsville, W. Va.—The New Martinsville Electric Light, Heat & Power Company has been organized with a capital stock of $50,000 for establishing an electric light plant. Frank Hall, N. C. Hamilton, J. C. Brady, C. M. Ford and T. M. Garvin are interested in the concern.

Pierce, Neb.—The business men have decided to have electric lights. A stock company has been formed by the citizens who agree to loan the town $5,500 to pay for the plant. Benjamin Lindsay is president.

Santa Paula, Cal.—This town is to have a modern electric light plant. Contractor Lockwood and Col. Driffill have selected a site near the warehouse for the building, which will contain all of the latest electrical machinery.

St. Joseph, Mo.—The Liberty Electric Light Company has submitted to the city a proposition to furnish 40 hydrants and 20 electric lights for 20 years for $4,500 per annum.

Tabor, Ia.—A special election will be held to decide the question of issuing $5,000 municipal lighting bonds.

Temple, Tex.—The council has granted to Mr. Strickland of Waxahachie a franchise for the building and operating of an electric lighting and power plant.

Wenatchee, Wash.—The Wenatchee Electric Light & Power Company, which was granted a franchise by the city June 7, 1901, expects to be in operation in the near future.

Williamstown, Ky.—Prominent men here are endeavoring to secure a franchise from the city council to place an electric light plant within the city limits, and their prospect of success is promising.

Woonsocket, S. D.—At a meeting of the city council it was decided to install an electric street lighting plant in this city at once.

Wrightsville, Pa.—The village council is discussing the electric light question.

Street Railways.

Buffalo, N. Y.—A syndicate of New York, Ohio and Michigan capitalists is at work, according to Frank S. Oakes, to secure the right-of-way for an electric road from Rochester to this city to connect with roads further west now in operation or under construction.

Carbondale, Ill.—A franchise for the Carbondale and Murphysboro Electric Railroad was lately granted by the board of supervisors.

Cleveland, O.—An ordinance has been introduced in the city council which, it is said, has been prompted by Mayor Johnson. It provides for franchises for at least 14 new new street car routes, some of which will parallel the present two electric systems, and the remainder of which will traverse new territory. A condition of the grant is that they shall be sold to the highest bidder and that only three cents fare shall be charged.

Columbus, O.—The Central Ohio Traction Company's capital stock has been increased from $100,000 to $600,000. The company proposes to build a railroad from Mt. Vernon to Marion with branches from Mt. Gilead to Galion and to Delaware.

Concord, N. H.—Incorporation papers were recently filed for the New Hampshire Traction Company with a capital stock of $1,000,000.

Elkhart, Ill.—The board of trustees has granted a franchise to the Interurban Electric Railway Company for a right-of-way through the village.

Fond du Lac, Wis.—The Fond du Lac & Oshkosh Electric Railway Company has filed articles of association with a capital stock of $100,000 for the purpose of constructing an electric line to carry passengers, mail and merchandise between those cities. Carl G. Geilfuss, George W. A. West and George Lines are the interested parties.

Hancock, Mich.—An electric train on a road a mile underground was recently placed in operation at the Quincy mine to haul copper rock.

Jeffersonville, Ind.—This place, New Albany and Sellersburg, are to be connected by an electric railroad. Louis Schenck of Seymour, Ind., J. H. Stotsenberg of New Albany and G. H. Voigt of this place are interested.

Knightstown, Ind.—A. D. Ogborn of Newcastle has secured from the county commissioners a franchise for an electric line along the national road in Henry County, a connecting link in the proposed line between Indianapolis and Richmond.

Los Angeles, Cal.—G. J. Griffith has aplied to the board of supervisors for a franchise to build an electric road to carry passengers, freight and United States mails on certain streets of this city.

Louisville, Ky.—The Louisville City Railway has placed orders for 100 new cars of the latest fashion, to be heated with electricity and furnished with vestibules.

Portland, Mich.—The Hawks-Angus syndicate has been granted a franchise by the village council for the use of streets for constructing an electric railway between Lansing and Grand Rapids.

Sheboygan Falls, Wis.—Sheboygan County is to have a new railroad concern to be known as the Wisconsin & Electric Railway Company. The line will run from this city to Plymouth. The capital stock is $100,000. G. B. Mattoon, J. Donohue, H. K. Loomis and E. L. Debell are the incorporators.

St. Louis, Mo.—The St. Louis, Kirkwood & Manchester Railroad has obtained a franchise from the St. Louis County Court to construct and operate an electric railway from this place to Manchester. D. C. Taylor of Manchester is president of the company.

Manufacturing.

Aiken, S. C.—The Secretary of State has issued a commission to a new enterprise to be known as the Renault Insulator & Electrical Manufacturing Company, the principal place of business of which will be some point in Aiken County. The incorporators are Edward Renault, of Waldo, Fla., Charles Warren Davis, John O. Wicker and George Nees, of Augusta, Ga. The capital stock is to be $25,000. The company proposes to manufacture electrical insulators from porcelain, mica clay, etc., and mine, wash and crush different kinds of clays.

Brooklyn, N. Y.—The Heaton Construction Company of this city has been formed to manufacture electrical appliances on a capital of $5,000. G. K. Harroun, Jr., and O. A. Samuels of Brooklyn, and Fred Peteler, of West Brighton, S. I., are the directors.

Chicago, Ill.—The Interurban Manufacturing Company of this city, capitalized at $16,000, for the purpose of manufacturing railroad and electric supplies, was recently incorporated by W. B. Davis, A. D. Bacci and L. Heislar.

Portland, Me.—The Ohio Railway & Light Company has been organized in this city with a capital of $100,000 for the purpose of manufacturing machinery and apparatus for electric light plants. C. D. Booth president, and H. M. Verrill treasurer, both of Portland.

Reading, Pa.—A number of local electricians will start an electrical supply factory about January 1, which will manufacture chandeliers, switches and every other sort of supplies.

Company Matters.

Lincoln, Neb.—The Lincoln Gas & Electric Light Company of this city has been reorganized with a capital of $1,500,000. The company will be managed and controlled by the McMillin interests of New York, which owns many similar plants throughout the country. Henry L. Doherty, the present representative of the company, will be president.

Wheeling, W. Va.—The Bellaire Electrical Company is the name of a new firm on 35th street in this city.

Power and Transmission.

Portland, Ore.—The Oregon General Electric Company has filed articles of incorporation. The capital stock is $2,000,000. The principal incorporator is F. S. Morris of the firm of Morris & Whitehead, bankers, who says: "We have acquired certain properties on the Clackamas River that include all riparian rights. There we shall erect our power plant and transmit the power about 25 miles to the city. It will probably require two years after the initial work is done before the plant can be in full operation. We contemplate the expenditure of at least $2,000,000, and it may require $3,000,000."

Roswell, N. M.—Messrs. Haynes & Wells of this place have bought 100 acres of land embracing North Spring River from Washington avenue westward. They are constructing a canal 20 feet wide and will divert the water of the river from the old channel into this canal. This water will be precipitated over a 14-foot fall into a turbine water wheel, thereby creating a 60 hp. plant.

Automobiles.

Chicago.—The West Park commissioners are considering a proposition to purchase an electric omnibus for $7,000. The vehicle is said to carry 48 passengers. It is capable of a speed of from 5 to 16 miles an hour, and is of 7 hp.

Saratoga Springs, N. Y.—The Fournier-Searchmont Automobile Company of this place was incorporated last week with a capital stock of $2,000,000, to manufacture motor cars, wagons, carriages and other vehicles. The directors are Spencer Trask, John L. Elliott, Acosta Nichols and Cecil Barret of New York City, Charles J. Peabody of Englewood, N. J., and C. G. Smedberg of Flushing, L. I.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, December 23, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	33	36
Broadway and Seventh Avenue	100	248	249
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	180	190
Dry Dock, East Broadway and Battery	100	120	130
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	162¼	162½
Ninth Avenue	100	196	205
Second Avenue	100	217	220
Sixth Avenue	100	175	215
Third Avenue	100	123	123¼
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	99	100
Brooklyn City Railway	100	242	243
Brooklyn Rapid Transit	100	64¾	64⅞
Baltimore United Railways, com	50	15⅝	15¾
do. do. do. pref	50	91	92
Buffalo Railway	100	99	101
Cleveland City Railway	100	109	110
Cleveland Electric Railway	100	85¾	87½
Columbus (O.) Street Railway	100	43	49
Jersey City, Hoboken and Paterson	100	16	20
New Orleans City Railway, com	100	26	27
do. do. do. do. pref	100	102	106
North Jersey Street Railway	100	22½	24
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	38	40
do. do. do. pref	100	94	96
St. Louis United Railways, com	100	35⅞	36
do. do. do. pref	100	89¾	60½
United Electric of New Jersey	100	280	281
PHILADELPHIA.			
American Railways	50	43½	43
Citizens	50	359½	360
Columbus Railway	100	45	45½
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	67	68
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23	23¼
do do pref	50	63	63¼
Dayton Traction	100	156	156½
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22¼
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151½
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205¼
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	97⅜	98
Railways Company General	5	2⅛	2¼
Reading Traction	50	32⅛	32¼
Ridge Avenue, $28 paid	50	308½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	• 310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	32⅝	33
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	166½	167
West End Street, com	50	93	93½
do. do. do. pref	50	111	112
CHICAGO.			
City Railway	100	185	190
Lake Street Elevated	100	10	10½
North Chicago	100	190	200
Union Traction, com	100	10½	11⅛
do. do. pref	100	48	51

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23¼	23½
do. do. do. pref	50	63¾	64¼
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	47	48

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Asked.
NEW YORK CITY.			
Electric Boat, com	100	19	21
do do pref	100	40	43
Electric Lead Reduction	100	1¾	2
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	2¾	3
do do pref	100	4	5
General Carriage	100	1⅝	1¾
General Electric	100	283	283¼
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	241	245
General Electric	100	281	281½
Massachusetts Electric Companies, com	100	30¾	31
" " " pref	100	94	94½
Westinghouse Electric & Mfg., com	50	73	73½
do do do pref	50	77	78
CHICAGO.			
Chicago Edison	100	155	156
National Carbon, com	100	19½	20
do do pref	100	83	84
PHILADELPHIA.			
Electric Company of America	50	6	6½
Electric Storage Battery, com	100	61	65
do do do pref	100	61	65
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1½
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	4⅝	4¾
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	197	200
Narragansett Electric Company, Providence	50	92	93
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Asked.
BOSTON.			
American Telephone & Telegraph Company	100	161¾	161⅞
Erie Telegraph & Telephone Company	100	17½	18
New England Telephone Company		133¾	134
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co	100	107	110
Commercial Cable Company	100	175	184
Franklin Telegraph Company	100	47	55
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	120	123
Mexican Telephone Company	100	2	2½
New York & New Jersey Telephone Company	100	167	170
Pacific & Atlantic Telegraph	25	78	83
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		91	91½
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	106	109
Cumberland Telephone & Telegraph Co	50	133½	133
Chesapeake & Potomac Telephone Company	100	72	75½
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		78	84
Hudson River Telephone Company	100	100	105
Northwestern Telephone Company, guar	50	122	126
Providence (R. I) Telephone Company	50	97½	98
Southern New England Telephone Company.	100	.	.

ELECTRICAL SECURITIES.

Closing Prices, Monday, Dec. 23

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1⅛	1⅜
Eddy Electric Manufacturing Company	25	8	8¼
Storey General Electric	10	9	12
Consolidated Car Heating	100	50	55
Standard Underground Cable	100	180	190
Pratt and Whitney, pref	100	84	92

STREET RAILWAY BONDS.

ALBANY.	Last Sale.	Int. Paid.
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	126	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	115½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120⅜	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106½	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117½	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115⅞	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 12¾@12⅞c.; **Lake**, 13@13⅛c.; casting, 12⅜@12⅝c.

A deal is said to be pending among the electric railroads converging about the city of Oskosh, Wis.

The General Electric Company, it is reported, has secured a $750,000 contract to equip the trolley system of Tokio, Japan.

The Oregon General Electric Company has filed articles of incorporation at Portland, Ore., with a capital stock of $2,000,000.

The stockholders of the Havana Electric Railway Company will hold their annual meeting at Asbury Park, N. J., on January 14. Books close December 24 to January 15, inclusive.

The Amalgamated Copper Company has declared a dividend of 1 per cent. for the quarter, a reduction of ½ per cent., payable January 27. Books close December 27 and reopen January 13.

The Twin City Rapid Transit Company reports for the month of November gross earnings of $268,517, an increase of $28,804, and net $154,073, an increase of $23,837; surplus, $78,224, an increase of $17,453.

The American Telephone & Telegraph Company has declared the regular quarterly dividend of 1½ per cent. and an extra dividend of ¾ per cent., payable January 15. Books close December 31 and reopen January 16.

The directors of the Central & South American Telegraph Company have declared a regular quarterly dividend of 1¼ per cent. payable January 8, to stock of record December 26. Books will close December 26 and reopen January 9.

The Central Lighting Company was incorporated in Trenton, N. J., recently with a capital of $1,000,000, to manufacture lamps, etc. The incorporators are Charles N. King, of Jersey City, and Emerson McMillin, Jr., and Cantine T. Scoville, of New York City.

The Metropolitan Street Railway Company has declared the regular quarterly dividend of 1¾ per cent., payable January 15. Books closed December 24 and reopen January 16. The retiring officers were re-elected for the ensuing year.

The Inter-Urban Telephone Company of Utica, N. Y., was incorporated at Albany on Monday to operate a telephone system connecting New York City, Albany, Rochester, Syracuse, Buffalo, Utica, Binghamton, Ogdensburg and other large cities of the State. The capital is $250,000, and the directors all live in Utica.

Boston people are interested in the Consolidation of the electric light, power and street railway companies of Savannah, Ga. There will be $6,000,000 of securities divided in $2,500,000 5 per cent. bonds, $1,000,000 6 per cent. non-cumulative preferred stock, and $2,500,000 common stock. The American Loan & Trust Company is trustee.

The producers of wire, wire rods and other products of wire, it is reported, are negotiating for the organization of a pool to sustain prices. Several of the concerns are known to favor such an arrangement, and believe that the manufacturers would be largely benefited by the same. This branch of the trade is one of the very few which are not governed by a pool.

Pending the complete ratification of the new Erie Telephone plan by the stock and bondholders there is likely to be considerable fluctuation in the stock according to well-posted interests. Many of the stockholders will be unable to take the preferred stock and may sell their present holdings. The 1928-9 bonds which sold at 90 previous to the plan being known, now find buyers at 94 while the other issues that sold around par are in demand at 101½. American Telegraph & Telephone stock is being bought on the idea that it will gather a large and valuable property.

There were no official announcements made Monday of cuts in the price of copper metal. There was a report circulated that the United Metals Selling Company was making private sales of the metal at less than its official schedule of prices. This was promptly denied at the office of the company, but among the manufacturers it was understood to be an actual fact. The independent producers are, of course, shading their prices, and the Amalgamated Copper Company will be compelled in time to meet these concessions. As far as the stock market is concerned, the lower the rate for copper, the more beneficial the effect on the market, because it will be realized that the plans of the controllers of the trust will be nearing completion Amalgamated Copper fluctuated narrowly, losing only ⅜ net to 66⅛. In Boston all of Copper stocks continued to decline, the feature being Calumet & Hecla, which dropped 25 points from Saturday to 550, closing at 555.

At the recent annual meeting of the Massachusetts Electric Companies, about 25 stockholders being in attendance, the annual report of the trustees, was accepted without reading. Five trustees to serve for a term of three years were elected by a vote of 103,901 shares of preferred stock and 110,044 of common, as follows: Gordon Abbott, Alexander Cochrane, Walter Hunnewell, Stillman F. Kelly and Reginald Foster. The only change is the election of Mr. Cochrane to succeed John N. Beckley. A vote was passed authorizing a change in the form of the certificates to hereafter be issued to shareholders so that the same will be signed by the treasurer instead of the president and secretary. A vote was also passed authorizing the trustees to sell or otherwise dispose of any part or the whole of 5,566 shares of the capital stock of the Newport and Fall River Street Railway Company, and any part or the whole of 2,875 shares of the capital stock of the Hyde Park Electric Light Company now held by them, and such other shares in these companies as may hereafter be acquired.

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THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

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EDITORIAL NOTES.

The New Year!

As we glide over the yearly border it is meet that we glance back over the year that is gone and gaze hopingly ahead at the year just dawning.

During 1901 the electrical industry has had little to complain of, as reports from all sides indicate that business has been good.

Aside from our domestic trade our export trade in electrical apparatus and machinery has been everything that could be desired. This is especially emphasized by a table of exports prepared by the Treasury Department, which shows that during 1899 the value of our exports in electrical machinery amounted to $2,736,110, increasing to $4,340,992 in 1900, and to the enormous value of $5,812,715 during the fiscal year of 1901.

Almost equally as great has been the increase in the value of the exports of instruments and apparatus for scientific purposes, under which classification are included telegraph, telephone and other electric apparatus. In 1899 the value was $4,399,180; in 1900 it was $6,435,766, and in the fiscal year just closed it reached the high-water mark of $7,361,231.

These figures would indicate a steady and healthy progress, and with the hope that the year 1902 will be no exception, we wish our friends and readers the compliments of the season.

* * *

Parcels Post.

Whenever the question of parcels post is raised in this country, either in Congress, through the columns of the public press or on the public platform, it constantly meets with certain opposition by those who should know better, on the alleged ground that it will prove to be an additional expense to an already overburdened postal system. As a matter of fact, it is hard to conjecture why the postal system of the United States, in these days of rapid transit and improved methods, cannot be run on a paying basis as easily as can those of European countries, where the labor is not so skilled, and where American ingenuity in labor-saving devices has not been brought into play as it has in the United States.

Take, for instance, the German postal system. It is far in advance of ours in many ways, and contains some innovations which are not well adapted for adoption by this country. Notwithstanding all this it is run on a paying basis. Not only does it meet its own expenses, but including its generous parcels post system in its work of last year, it paid into the German treasury a surplus of 51,844,870 marks, or an equivalent of $12,442,768.

If Germany can make such a liberal parcels post system pay, with her slow-plodding methods, is it reasonable to suppose that the United States Government, with the bright intelligence of American inventors at its beck and call, cannot give the same beneficial results to this country?

It is not a question of whether, if properly conducted, the system will pay in the United States. It is, rather, of whether the postal authorities having the matter in charge can be induced to allow free-born Americans to enjoy as fair, reasonable, cheap and reliable parcels post service as is enjoyed by the subjects of the various European countries.

* * *

The Bridge Problem and the New Municipal Administration.

Regarding the Brooklyn Bridge improvement problem, to which we have several times referred in these columns, Chief Engineer Martin in a recent report on the subject of the proposed improvements to the Manhattan terminal, recommended certain changes and extensions on the structure which he approximates will cost nearly $3,000,000. Part of the plan is for the construction of an elevated road along Centre and Spring streets to the terminus of Bridge No. 2 and that a branch of this line connect with Bridge No. 3.

The recommendation of the Board of Engineers for a double-track elevated line along Vesey street from the Manhattan terminus of the Bridge, which plan the board regarded as very important, Mr. Martin wants omitted. He says that there would be a series of grade crossings where the loaded trains of the Centre and Vesey street lines would come together and the safety of the passengers would be endangered.

Mr. Martin recommends the plan providing for a conversion of the second floor of the Bridge at this end into a trolley terminal.

His report in part follows:

"The Board of Expert Engineers recommended—

"In accordance with Chapter 712, Laws of

1901, a Board of Expert Engineers was appointed by you to consider and report upon the Manhattan terminal of the New York and Brooklyn Bridge. The report prepared by this board, and dated October 8, was submitted to you, and has been referred to me for consideration and report.

"The board made certain recommendations which I will consider and report upon in regular order:

"(1) That an elevated road be built from the Manhattan terminus of the New York and Brooklyn Bridge along Centre street and Marion street to Spring street, and thence along Spring and Delancey streets to the terminus of Bridge No. 2; and that a branch of this Centre street line be built on Canal street to the terminus of Bridge No. 3. That the first named portion be completed by the time Bridge No. 2 shall be completed, and the Canal street branch be completed by the time Bridge No. 3 shall be opened for travel. That that portion of this elevated road from the Bridge terminal along Centre street to Canal street be constructed with four tracks, the remainder to be double track road. That the portion of the proposed elevated road from the existing Bridge terminal to a point on Centre street north of Worth street be built at once, and a commodious station be built at Worth street, with sidings and switches north of this section for tail switching and returning trains.

"I recommend that the Centre street line turn into Grand street so as to pass over and connect with both the Second and Third Avenue Elevated Railroads, where stations now exist, instead of turning into Spring and Delancey street as recommended by the board, where there are no stations.

"As soon as that portion of the proposed elevated road is built from the existing Bridge terminal, through Centre street and through Grand street, up to and beyond the Second Avenue Elevated Railroad (on Allen street) an immediate relief to the congestion at the Manhattan terminal of the Bridge railway will be obtained because passengers on their way to the present Bridge by way of the Second and Third Avenue Elevated Railways, will transfer at the Grand street stations to trains that will approach the Bridge on the Centre street extension of the Bridge railway.

"Again, the proposed stations at Worth, Canal and Grand streets will be used by the people who come from points west of Centre street and north of Duane street, who, now go to the present Bridge terminal. Those stations will be nearer to them than the Bridge station, and by taking at that point the cars that will pass over the bridge, they would avoid the rush at the Bridge entrance. The branch of the Centre street line that is to pass eastward through Canal street to connect with Bridge No. 3 should be built in time to be ready for use by the time that bridge is completed.

"I would recommend that work be commenced at once on the entire line that is to connect the present Bridge terminal with Bridge No. 2, for probably that Bridge will be ready for use by the time this connecting line can be built. In order to accommodate the passenger travel to or from the other bridges, it will be necessary to construct two additional platforms in the present Bridge railway station in addition to those shown in the report of the Board. These platforms will be located mainly outside of the present building, and will have connections to the second story of the station.

"(2). That a double track elevated road be built as soon as practicable from the Manhattan terminus of the New York and Brooklyn Bridge southward along Park Row and across Broadway to Vesey street; thence westward along Vesey street, crossing the Sixth and Ninth Avenue Elevated roads, above grade to West street, and southerly along West street to the vicinity of the Cortlandt street ferry on North River. That the terminus on West street be provided with a suitable station and such extra sidings and switches as will enable trains to be returned to the Bridge. That a commodious station be built on Vesey street, between Church street and West Broadway, with connections by stairs and platforms to both Sixth and Ninth Avenue elevated roads. We regard this Vesey street line as very important, and it is strongly recommended; but it is independent of the Centre street line, and its omission would not effect the other improvements recommended."

As was to have been expected the outgoing Board of Estimate and Apportionment declined to act favorably upon the proposed plan with the result that the incoming administration will have to grapple with the problem. Mr. Gustav Lindenthal, the newly appointed Commissioner of Bridges, is, as is well known, an able engineer and it will devolve on him to remedy the existing unsatisfactory condition of affairs. It is sincerely to be hoped this will be done as soon as possible after the congratulatory speeches and handshakings are over.

◆

UNDER THE SEARCHLIGHT.

Notes and Comments on Various Topics.

A LARGE gathering of electro-chemists is expected at the Philadelphia meeting of the American Electro-Chemical Society to be held some time in April. The Society will start off with a membership roll of 300.

◆

MAYOR HARRISON of Chicago will attempt to have the question of municipal ownership of street railways submitted to the voters at the approaching city election.

◆

THE Electrical Contractors' Association of Buffalo, N. Y., was incorporated December 26 to foster the interests of persons connected with the electrical profession in that city. The directors are Herbert I. Sackett, Albert Mann, Ferdinand D. Jones, William P. Mashintes and Julius C. Sterns of Buffalo.

◆

THERE have been more than seven hundred stock companies incorporated in this State during the year. This is considerably more than during the previous year. The average capital of the companies is also larger.

◆

THE London County Councils are contemplating the erection of electrically-controlled and illuminated clocks in the streets of the metropolis.

◆

PROF. H. V. EGBERT, of the Chair of Science of Buchtel College, Akron, O., thinks communication with Mars is likely as a result of Marconi's success in wireless telegraphy. He thinks the chances about even that during the present century the earth and Mars will establish communication with one another. "While," he says, "the chances are that the people of Mars have a language different from our own, it is equally true that the deaf and dumb are able after a time to decipher the meaning of certain dots and dashes, and if this be true why should not the people of Mars be able to do the same?"

◆

THE fact that electricity is now advocated for glass making arouses the hope that Niagara Falls is destined to become the center of the glass making industry of the United States. It is at the Falls that electrical furnaces may be operated more economically than in any other place in the world, the vast supply of electricity and the constant current service making this possible.

◆

As the latest instance of the vagaries of triumphant democracy with ratepayer's money, the Municipal Council of Paris is going to spend $1,200 to light the Morgue with electricity.

◆

A DISPATCH from Valparaiso, S. A., says that a Sandy Point commercial house has offered to lay a submarine cable from Puerto Montt to Sandy Point for $4,000,000.

◆

CHARLES P. TONORAY and George E. Boren have returned from New York to Elizabethton, Tenn., after closing negotiations with the Electric Furnace Company for the erection of an electric steel plant at Elizabethton. It is said that by this method steel ingots can be produced directly from iron ore in thirty minutes. An 8,000 hp. electric plant will be commenced as soon as the site can be decided upon on the Watanga River, near Elizabethton, and this will supply the power for the plant.

◆

THE fourth annual international automobile exhibition, which was held in Paris last month in the Grand Palace of the Champs-Elysées, surpassed anything of the sort hitherto attempted there. There were over 700 exhibitors on the list, and these were all French firms, with the exception of a score of Germans, Americans, English and Belgians.

◆

PRESIDENT JOHN M. HALL, of the New York, New Haven and Hartford Railroad Company has awarded the contract for the important new roller lift bridge which is to be part of the $3,000,000 improvements of the New Haven Railroad property in Bridgeport, Conn. The new bridge will be four-tracked, with a span or 70 feet clear. It will be a deck-structure and composed of parallel double-tracked spans operated jointly or singly, the motive power being electricity. The time of operation will be less than 30 seconds. An advantage in the design adopted is that future expansion of the railroad can be met by adding double-track spans to the present structure, instead of building a new bridge. With the new bridge in operation Bridgeport will be supplied with one of the most effective railroad bridges in the country.

◆

THE Navy Department has taken the initial steps toward the adoption of wireless telegraphy as a means of signaling between warships at sea. To this end Admiral Bradford of the Bureau of Equipment has asked that the armored cruisers of the Pennsylvania class have their masts and rigging so arranged that the wireless system can be introduced. This will necessitate lengthening of the masts of the ships and the insulation of the metal rigging by the use of hemp covering for halyards. It is intended to get test sets of instruments of the various wireless systems now being operated. These include the Marconi system. Thus far, however, the Navy Department has not adopted definitely any system, but the construction of the new ships is regarded as a preliminary to the adoption of a system whenever its practicability is established fully. The British navy already has a number of its ships equipped with the wireless system, but this is the first move on the part of the American navy to make use of a wireless plan.

* * *

THE owners of automobiles are having many of the annoyances and legislative controversies which beset the riders of the bicycle a few years ago. The officials in more than one State are discussing plans to tax automobiles of all descriptions. Members of the Automobile Club of America have discussed the proposed taxation with considerable feeling lately, and say that such a tax, if aimed at automobiles solely, savors too much of class legislation. George F. Chamberlin, chairman of the law committee of the club, says that owners of automobiles will not make any particular fight against the tax providing that all pleasure vehicles are taxed at the same time. "Everybody knows," Mr. Chamberlin added, "that the motor machines have rubber tires, and that tires of this description are good road makers and do not injure the highways like narrow wheels and metal tires. In case such a tax becomes a law, then the money should be used for the improvement of the highways."

* * *

THE question of electrifying its entire system is now engaging the attention of the London & Northwestern Railway, Great Britain's greatest railroad, and the matter seems to have reached such an advanced stage as to justify its mention in the financial columns. The London "Globe" says that the directors and experts who were summoned for consultation are said to have formed the opinion that the road could thereby considerably accelerate and cheapen its service.

* * *

IT is predicted by people of Batavia, Ill., that Boreas, driving a windmill, will, at no far distant day, illuminate the farm. The reason that the windmill has not been used to generate electricity to light the farm is that up to this time a storage battery cheap enough to serve for the purpose generally has not been invented. Nothing short of such a battery will answer, for the wind does not always blow when the light is wanted and it is therefore necessary to store the current to make it practicable. Eastern inventors have been busy with this problem for some years and it is asserted that considerable progress has been made. The difficulty seems to be that a battery capable of performing the desired function costs too much to come into general use on the farm. When this obstacle is overcome, and the windmill people say it will be, the farmer may harness the wind and illuminate his house and farm buildings of all kinds as well as the lanes and driveways leading to them.

A GERMAN TROLLEY OMNIBUS LINE.

BY FRANK C. PERKINS.

In the year 1881, the firm of Siemens & Halske experimented with a trolley wagon, using an electric circuit overhead consisting of two trolley wires, upon which a small truck was mounted and drawn along by a cable attached to the electric wagon. This was used on the outskirts of the city of Berlin, and worked successfully, the roads being comparatively smooth and with little or no grade. The motors were placed under the seat and operated the rear wheels by sprockets and chains.

Recently an electric trolley omnibus line was placed in operation by this company which has given exceedingly good satisfaction for the purpose it was intended. The line is nearly 12 kilometers long and extends through the beautiful valley of Bielabach, from the village known as Konigstein to Hutten and Konigsbrunn. The accompanying illustrations show the omnibuses as they pass each other, and other vehicles on the road. In passing another electric bus it is of course necessary to remove the trolley poles, while in passing other vehicles it is only necessary to steer to one side, as the poles are of sufficient length to allow a side movement of three meters from the trolley line. The controller is similar to that used for street cars of small size. The storage battery was suggested, but given up as being too heavy and costly, both in first cost and maintenance, all things considered. A speed of 12 kilometers per hour is usually maintained and the vehicles will hold 21 persons. The under-running trolley was decided upon as the most advantageous from past experience, and for country use this is claimed to be an ideal construction where a cheap means of transportation of passengers and freight is desired.

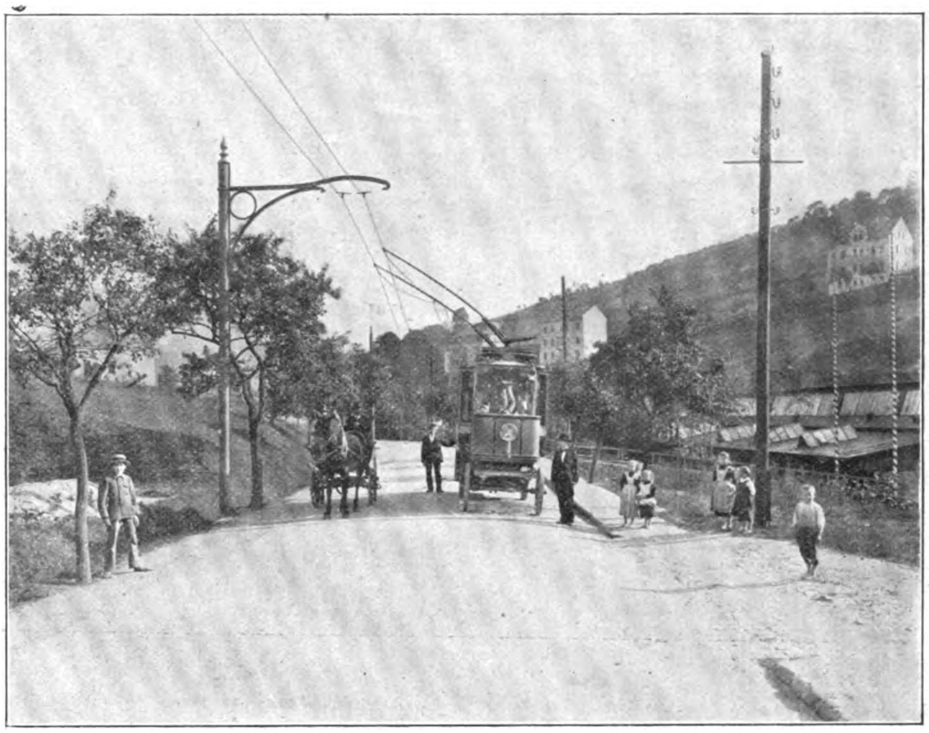

FIG. 1.—SIEMENS & HALSKE ELECTRIC TROLLEY OMNIBUS PASSING A ROAD WAGON.

Trailers for freight have been used with good results, and this suggests the idea that possibly in this country, when the country roads have been sufficiently improved, lines from farms to cities may be equipped with overhead conductors, and farmers of progressive turn may equip their wagons and other vehicles with motors, trolley poles, etc., and bring the garden truck to the city market, paying for the necessary power at fair rates.

* * *

THE VELOCITY OF STEAM.

BY W. H. WAKEMAN.

The statement has been made, and evidently believed by some engineers, that if a round hole one inch in diameter should be bored in the shell of a tubular boiler, above the water line, it would be impossible to make steam fast enough in that boiler to maintain a working pressure. The size of the boiler was not given when I heard the above statement, except that it meant any boiler in ordinary stationary practice.

As many engineers have never given their attention to such matters, except in a very general way, I have concluded to make a sort of test case of this in order that the truth or falsity of it may be demonstrated so far as it can be by the application of well-known principles, or in other words, it will be proved from a theoretical standpoint.

It is evident that our first business is to find how fast steam travels under these conditions, and here is a question on which the doctors seem to disagree, to use a common expression, for its velocity is stated at 900 feet per second by some writers, at 1,450 by others, while the highest statement I have read places it at 3,500 feet.

I can understand the cause of difference between the two former, but the latter surpasses my comprehension, therefore I leave it as a mystery for somebody else to solve.

It is an axiom that the velocity of steam as it emerges from a hole is due to the pressure behind which forces it out against atmospheric, or other pressure, but just how this pressure affects it is a point for consideration.

The velocity of steam is influenced in the same way that water is, when coming out of an orifice, at least to a certain extent. If we take a U shaped pipe, both sides of which are

100 feet high, place it in a vertical position and fill it with water, the pressure at the base will be directly in the height of the columns of water, and it may be determined by multiplying the height by .434 and 100 × .434 = 43.4 pounds. If we now proceed to cut off one side of this pipe at a distance of 58 feet from the top, the pressure under which the water will flow from it, provided the longer part is kept full, is 58 per cent. of the full pressure and 43.4 × 58 = 25.2 pounds, because it is due to the difference in height between the two sides of pipe.

We may prove this by calculating the pressure due to the height of each and subtracting the lower from the higher. Cutting off 58 leaves 42 feet and 42 × .434 = 18.2. Then 43.4 — 18.2 = 25.2 pounds.

This illustration is introduced to show that in order to use the rule to be explained later on the lower pressure must not be more than 58 per cent. of the higher, but it may be any lower pressure without detriment.

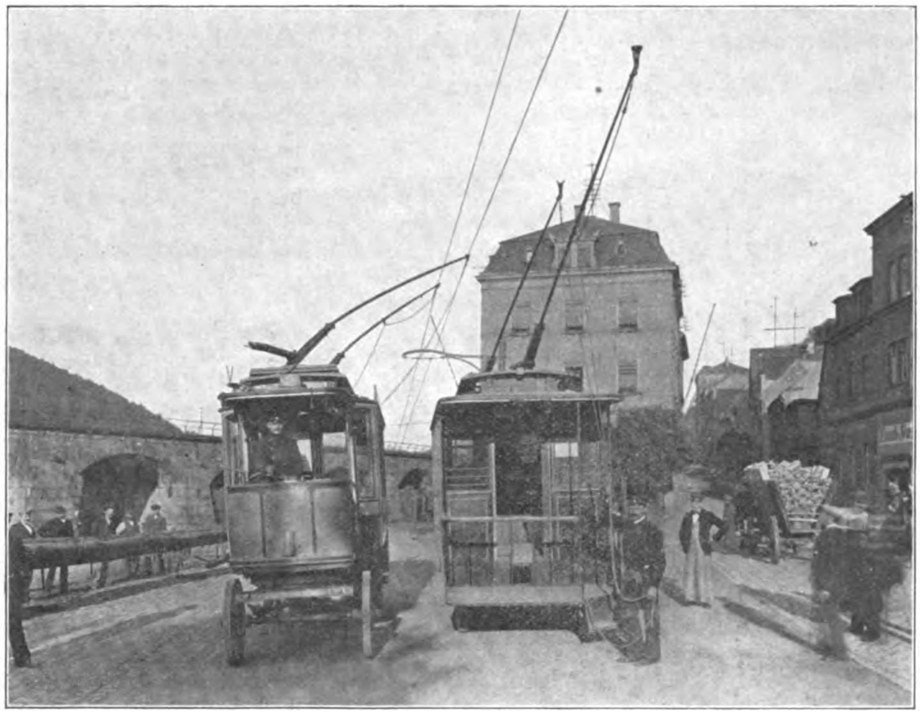

FIG. 2.
Siemens & Halske Konigstein Electric Trolley Omnibus Line. Trolley poles of one bus removed while passing the other.

Applying this to ordinary conditions where steam is blown into the air at sea level, we find that the lowest boiler pressure to be used is 11 pounds by the gauge, which is determined as follows:

Atmospheric pressure is taken at 15 pounds and as this is 58 per cent. of some number, we may determine what that is by dividing 15 by .58 when the quotient is 26 pounds absolute, or 11 pounds by the gauge. Inasmuch as this is the least differenee to be allowed it naturally follows that we may raise the boiler pressure as much as we desire without impairing the value of the rule for the velocity. It also follows that the lower pressure may be reduced to any point desirable, therefore if the steam is discharged into a vacuum the rule still holds good.

I may remark here that this does not seem logical, but it is the results of direct experiments and these cannot be disputed.

It is necessary to give the laws which govern the action of falling bodies some attention, as the velocity of water coming out of a pipe, or of steam blown into the air, is determined by the same law which gives velocity to a common ball when dropped from the top of a church steeple. Friction modifies the results in all cases, but does not repudiate the law.

If a weight be dropped from an elevated place, under conditions which prevent friction, it will fall 16.1 feet in one second, but it started from rest, therefore its final velocity must be double its whole travel, or 32.2 feet, as its motion is uniformly accelerated, and this will give it a velocity of 64.4 feet at the end of the next second. At the end of the third it will be 96.6 feet and for the fourth it will be 128.8 feet.

If it falls 16.1 feet during the first second, and its motion is uniformly accelerated, it will fall 32.2 feet during the next with the acceleration due to the first, to which must be added the 16.1 feet due to gravity, making 48.3 feet in all during that second, or 64.4 feet for two seconds, so that by squaring the time in seconds and multiplying by 16.1 the height may be determined.

It follows that if we know the height we can determine the velocity which is the point of more especial interest in this connection. The rule for this is to find the square root of the height in feet, and multiply it by 8. This rule is based on the principles above referred to.

Suppose that we have a vertical pipe of unknown height, full of water, and we wish to know how fast this water will run out through an opening at the bottom. Connecting a gauge to the bottom we note that the pointer indicates 43.4 pounds. Proceeding to multiply this by 2.3 the height is found to be 100 feet.

The square root of 100 is 10, and 8 × 10 = 80 feet per second. Study of the foregoing leads to a clear understanding of the rule for the velocity of steam as it is based on the same principles. The steam gauge on a boiler indicates the pressure the same as the gauge on the column of water does, and from this we may determine the height of a column of steam that would produce an equal pressure, if held in a vertical pipe, provided the lower part of it was filled with steam of density equal to that in the upper part of it. If it was practical to erect such a column, the lower part of it would be much more dense, as the weight resting upon it would produce this result, but it is assumed to be of equal density throughout.

Suppose that the absolute pressure is 100 pounds, and we wish to determine the corresponding height of a column of steam 1 inch square. A cubic foot of steam at 100 pounds pressure weighs .2307 pound. If it were to be divided into columns 1 inch square, 1 foot long and set one upon the other it would stand 144 feet high, therefore a column 144 feet high weighs .2307 pound. 144 ÷ .2307 = 624.18 feet required to weigh one pound and 624.18 x 100 = 62,418 feet required to weigh 100 pounds.

Put into the form of a rule this reads as follows: Divide 144 by the weight of one cubic foot, and multiply the quotient by the given absolute pressure.

The square root of 62,418 is 249.8.

It is not proper to multiply this by 8 as in the case of water, but by 3.6, as experiments have demonstrated this to be correct. Then 249.8 × 3.6 = 899.28 feet per second, which fully accounts for the speed of 900 feet mentioned in the first part of this article.

This is the rate before expansion takes place, but the instant that pressure is relieved, it begins to expand to atmospheric pressure at a ratio of 1.624, therefore the velocity is increased at the same rate, and 899.28 × 1.624 = 1,460 feet, which accounts for the greater speed given by some writers.

When calculating the weight of steam discharged per hour from a boiler there are at least two ways of doing it, one of which is to take the velocity at the expanded rate, and the weight per cubic foot at the expanded pressure, which in this case is 15 pounds.

The other is to take the velocity due to the pressure, or, in other words, to the height, as already explained, without expansion, and the weight at boiler pressure, which plan will be adopted here.

A round hole one inch in diameter contains .7854 square inch, and the length of the stream of steam coming out in one second is 900 feet, or 10,800 inches.

Then 10,800 × .7854 ÷ 1,728 = 4.91 cubic feet per second, or 17,676 cubic feet per hour, which weighs .2307 pounds per cubic foot. This makes 17,676 × .2307 = 4,077 pounds of steam per hour.

This will not be realized from an ordinary hole drilled in the shell, because it does not give the most efficient form.

If the hole was reamed out from the inside, so as to make a bell-shaped orifice, it would give the best result, but where a straight hole is drilled and nothing more done to it, we cannot expect to get more than .8 of the full capacity and 4,077 × .8 = 3,261 pounds, or more than 100 hp. if the feed water is supplied at 100° F.

A tubular boiler 66 inches in diameter with 100 three-inch tubes 15 feet long will supply this steam, if well set where there is a strong draft, using good coal. A smaller boiler can be made to do it, but it is not advisable.

* * *

NOTHING sweetens or freshens stale air better than ozone, says the "Lancet," and now that most of the railway companies have successfully adopted a system by which each carriage on its journey develops by means of a dynamo attached to the axletrees its own current of electricity for lighting purposes, there is no reason why the same current should not be utilized at the same time to ozonize the air of the compartment. The quantity of ozone required is small. The result would certainly be good, since the ozone has a remarkably destructive action on aerial impurities and unpleasant smells, and gives the air a degree of freshness similar to that of the sea breeze.

ACCUMULATORS AND ELECTRIC TRACTION SYSTEMS.*

There are probably few subjects connected with electrical engineering upon which more divergent views are held than the question of the utilization of accumulators in relation to electric traction systems. While the various merits of high speed and low speed engines, alternating and direct current systems of electricity supply, and other matters of cognate interest to the profession generally, have been pretty well threshed out before various learned societies, and in the technical press, this question of the employment of accumulators under the conditions obtaining in electric traction systems in this country does not seem, up to the present, to have been placed on the firm basis of a standard practice. And on reflection this apparent want of unanimity as to the employment or otherwise of the class of apparatus in question is the more striking, having regard to the fact that the sweet unction that English engineers have been laying to their souls for many years past, anent their apathy in the field of traction apparatus, was the thought that after the Germans and Americans had finished spending the large sums of money they had so lavishly poured out on experiments and had definitely arrived at the survival of the fittest, then—*then* would be the time to take advantage of the wheat which had been laboriously separated from the chaff, and to follow along lines which bitter experience had dictated to be the best. This being so, it is curious that the employment of accumulators on traction systems is so largely followed in America and on the Continent, and is only beginning to make headway in this country.

Storage batteries in connection with electric traction systems may be divided broadly into two classes:—

1. Where the battery is situated close to the power station, in which case its function would be purely and simply that of a "load leveler," and it would flatten out the curves of the output of the station by smoothing off the peaks and leveling up the hollows.

2. Where the battery is situated some distance away from the power station, either at some distributing center or at the end of a feeder. In this case—while the battery would level up the load on its own section by discharging when any sudden demand for current was made, and be conveniently charged when the load went off and the volts rose—its chief and most important function would be as a potential regulator, thus effecting the saving of a considerable amount of capital outlay in copper, which would have been necessary for feeders if the battery sub-station had not been adopted, whereas by its means the heavy demands for current can, so to speak, be dealt with locally, being furnished by the battery instead of it being necessary to convey the current, in some cases it may be several miles, through a cable that must be of sufficient size to carry it without any undue drop in voltage. Where extensions of the system are decided on battery sub stations have in many cases proved the most economical way of meeting the new conditions. Take, as an example, the case of a spur line which it is proposed to extend in a direction away from the power house, or on which, owing to the growth of traffic, it is necessary to increase the number of cars; this may mean the sinking of more capital in copper, or, if the extension is for any considerable distance, a new power house. A battery sub station would in most cases be less in first cost than fresh feeders, and certainly cheaper than a new power house, and in the case of a tramway operating without batteries, would probably enable the existing plant to deal with the increased load with little further outlay than the cost of the sub-station.

It may be urged that a properly designed traction generator should be capable of standing heavy momentary overloads without detriment, which is, no doubt, true, but it is incontrovertible that steam (and therefore coal) is economized by operating at constant full load without violent fluctuation. In small traction stations for systems running from 10 to 25 cars, more particularly where the routes are at all hilly, the load may vary between 500 and 600 per cent., necessitating the running of sets which must be capable of taking these violent peaks without injury, and are consequently loaded most uneconomically during the period that elapses between them, whereas by the employment of a battery in parallel the variations can be enormously reduced. This means not only that the plant can be run throughout the day under the most economical conditions, but also that owing to the violent fluctuations of the load being removed from the generators and taken up by the battery, a smaller unit can be employed, resulting in a considerable saving of capital outlay.

As regards the use of battery sub-stations for keeping up the voltage of the line, it may be suggested that a booster would fulfill the same purpose, be cheaper in first cost and maintenance, occupy less space and require less attention, and, further, that feeder copper is a better investment than lead. Let us examine this contention in detail. The fact is sometimes lost sight of that a battery sub-station takes care of the local demands, that is to say, takes off the peak of the load in its neighborhood, and the copper to the sub station need, therefore, be calculated for only an average load and not a maximum, effecting a saving in first cost of copper, reducing copper losses, and enabling extensions to be carried from the sub-station only instead of, perhaps, the power station itself. The use of a booster for keeping up the voltage does not in any way reduce the fluctuations on the generating plant, but would accentuate them, because the drop in volts on the line would tend to reduce the rush of current due to the starting of the cars, whilst a booster, by keeping up the volts, would cause bigger rushes of current than if it were not employed.

Again, a breakdown of the generating plant would not entail an entire stoppage of the system if there were battery sub-stations, which unfortunate event would not be mitigated in any way by any number of boosters. Electric traction systems have in most instances competitors of various sorts for the privilege of carrying the traveling public, and cannot afford now, and will probably be still less able to do so in the future, when their competition is recognized and steps have been taken to meet it, to allow public confidence in them to be shaken by anything approaching frequent breakdowns. Reliability is of the utmost importance, and the steps taken by American engineers to insure that first, foremost, and beyond everything, the service for which they are responsible shall be as free from breakdown as human forethought can possible make it, would, we think, be a revelation to many engineers on this side.

Not only is the boiler, engine and generating plant in the best practice in duplicate, but batteries of such a size are employed as to render a stoppage of the system a matter of extreme improbability. We have no wish to harp unduly on the American string, but the fact remains that there is hardly a traction plant of importance in the States that is not employing batteries. If it pays Jonathan, it ought to pay John.

For lighting the car sheds at night while the cars are being cleaned, moving the cars about the depot, bringing home the late cars, and running the early morning cars, a battery serves a useful purpose, enabling the steam sets to be entirely shut down, and affording an opportunity for inspection and repairs, which would not otherwise be obtained. In small traction stations a battery of suitable size for this class of work would be a useful adjunct in the event of a breakdown of machinery, as it could give heavy discharges for short periods till repairs were effected, or another set gotten under way.

With three-phase transmission and rotary converters in sub-stations, the use of batteries enables the efficiency of the plant to be raised to a considerable extent. The rotary can be run at a uniform load, and need not therefore be capable of dealing with the maximum load, which would be taken by the battery. The starting of the rotary is also a simple matter under these conditions, the direct current end being supplied with current from the battery, and thus obviating any complicated devices or unnecessary auxiliaries.

In England, up to the present, the greatest activity in electric tramway development has, not unnaturally, taken place in the larger towns, and the plant has, in many cases been installed, which is capable of dealing with the very considerable extensions which are probable in the near future, that is to say, the size of the generating units is large for the present output of the station, and the sub-stations, where such are employed, contain plant capable of dealing with a much greater output than is at present called for. Take, for instance, Glasgow, where the whole of the tramway system of the city is driven during a large portion of the day by one generating set, although four sets are installed. In such a station there is a large margin of both engines and generators to cope with the fluctuations of the load, and it would seem probable that when it is necessary to run two sets during periods of extra heavy traffic, they must be uneconomically loaded. But in a tramway system as laid out in Glasgow, with rotaries in sub-stations, the advantageous use of batteries in connection therewith will, as the system extends, become apparent. They would reduce the amount of machinery running at the station, by taking the peaks, and would also enable the sub-stations to deal with a larger number of cars, and run at a steadier load, while they would allow of extensions to the outlying suburbs without any further outlay on copper between the sub-stations and the power house. In other words, the use of battery sub-stations would permit of the use of smaller units in the power house, or, with a given size of unit, would enable more cars to be run.

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*From the "Electrical Review," London.

The practice of connecting a battery of such a number of cells as will give the average voltage of the power circuit at the point where the battery is located, in parallel with the load, seems to be rapidly disappearing in favor of a smaller number of cells discharging through a booster. The demands for current from the battery are, of course, extremely fluctuating in character, and at times are very heavy if the routes are hilly, the cars get bunched, or for other reasons. Consequently, just at the very time when the assistance of the battery output is most needed, its voltage drops, owing to the heavy calls upon it, and the object of its existence is to some extent nullified. This drop in volts, could, of course, be remedied by putting down a battery of such a size as would give the output called for without discharging at a rate which would bring about a heavy drop in its voltage, but in any case, a battery by itself across the mains is not so "lively" as a battery discharging through a booster. This enables a smaller size of battery to be installed, effecting a saving in capital outlay and—an important point in some cases—requiring less floor space. The fluctuations in load are taken up by the booster for charging the battery, thus reducing the time required for this operation at the end of the day. Moreover, the watt-hour efficiency of the battery is very considerably improved (by an extent which will more than compensate for the power required to run the booster), being as high as 85 to 90 per cent. when working under these conditions. This somewhat abnormal efficiency is due to the fact that, when working through a reversible booster on a traction load, the discharge is followed so rapidly by a charge that the increased voltage due to gassing is taken full advantage of, and the average EMF. per cell is more than two volts, even on a heavy discharge.

By this means the battery at the end of the day's run is practically full charged and ready for the night load, and the heavy discharges taken from it have nothing like the exhausting effect which they would have if the old method of running the battery down were employed. The effect of the battery discharging through the booster has practically the same result as though the battery had no internal resistance. That is to say, the combination gives practically the same voltage at any discharge rate.

Another important innovation in this connection is the absence of any regulating cells. Several ingenious devices have been patented in the past to automatically cut regulators in and out as occasion demanded, but it cannot be said that in the traction field they have been a success, and by removing this weakness a distinct progress has been made. The regulators in a battery were always the weak point, due principally to the fact that the amount of work they were called upon to do differed from that performed by the rest of the battery; to treat the battery as a whole, and to maintain a constant voltage by an automatic booster, removes one difficulty at any rate.

In these days when the question of cost is so keenly discussed, and with numerous examples of what has been done in this direction constantly appearing in the press, it seems somewhat strange that fuller advantage has not been taken of the economies which a battery offers in this connection. It may be that as this branch of electrical engineering emerges more fully upon that phase of activity of which it at present gives such bountiful promise, the extension of tramways in all directions will create conditions which can only be met satisfactorily—as they have been in other countries—by the extensive employment of batteries.

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PRINCIPLES OF DYNAMO CONSTRUCTION.—VIII

(Written for ELECTRICITY.)

In the accompanying sketches are examples of the most popular styles of frames. Each possesses different qualifications, which make it valuable for special work.

There are a thousand and one developments of the above types in existence, each differing from the other by some slight change suggested more by the designer's fancy than for any sound, substantial reason. Distorted forms of the above styles have occasionally appeared, but, in general, such startling variations created often for the sake of mere novelty have become defunct.

There are a few machines still in existence capable of great improvement, that were sold by large established companies, but they are all succumbing to the heavy tread of progress and soon will be placed beside other obsolete forms as an historical remnant of engineering practice.

The general statements just given regarding the loss of lines of force from different types of machines cover the ground without expressing exact values. Kapp and other writers have compared the flow or radiation of lines of force from a magnetized body to a primary battery submerged in a badly conducting medium. In such a case there would be a general escape of currents from different parts of the circuit, varying in strength with the length or resistance of their respective paths. Though it is difficult to state with the authority of truth the exact paths through which leakage must occur, we may assume with absolute surety, that between those two points having the greatest difference of magnetic potential the leakage would be the greatest. This analogy between a magnetic and an electric circuit immediately presents to our notice the causes of the most serious cases of leakage.

An approximation bringing us to within 15 or 20 per cent. of the true value of leakage, according to one writer, will be sufficiently close for practical purposes. By a careful consideration of the surfaces lying near to each other and the proper determination of the magnetic pressure acting between them, the predetermination of the leakage factor becomes a matter of great surety, though involving tedious labor of a somewhat empirical character.

All parallel surfaces can have their reluctance determined by a very simple method. If two sets of surfaces be considered as represented in Fig. 12—

R = reluctance
l = distance
A = area of surface,

$$(1) \quad R = \frac{l}{A}$$

The reluctance of the first case will be $\frac{l}{A}$, and of the second the distance divided by the mean surface, or

$$(2) \quad R = \frac{l}{\frac{A_1 + A_2}{2}} = \frac{2l}{A_1 + A_2}$$

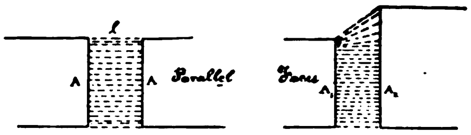


FIG. 12.

If the two cases just given be grouped under one heading as: Two parallel surfaces of equal and unequal areas, then those surfaces may be also grouped into one class which lie in the same plane. See Fig. 13.

The distance between surfaces in this position may vary, that is to say, the distance between them measured in the same plane in which they lie. This would naturally vary the reluctance and bring into existence an infinite number of cases to be considered.

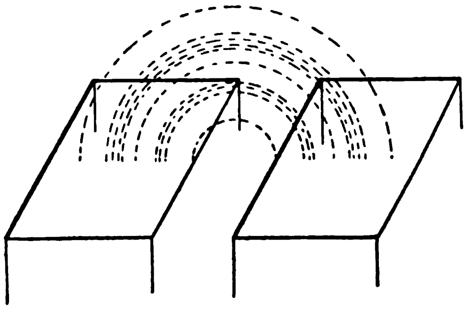


FIG. 13.—SURFACES IN THE SAME PLANE.

It is not the object of the writer to recommend these methods as being the best, because leakage calculations involve other variable quantities, whose use will present doubtfull issues to our mind. For instance, the magnetic potential cannot be known with any great degree of accuracy at different parts of the frame. Mr. Ravenshaw, of the English firm of W. T. Goolden & Co., has made calculations from the sketches of machines to within two per cent. of their actual values.

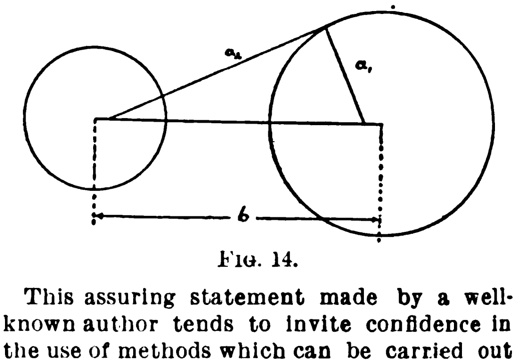


FIG. 14.

This assuring statement made by a well-known author tends to invite confidence in the use of methods which can be carried out with such success. New formulæ, however, would be necessary for every difference of position occupied by the iron parts; therefore, to cover the general run of cases, these three conditions are presented. (1) Parallel faces. (2) Surfaces lying in the same plane. (3) Two parallel cylinders. The last case is well covered by a table of Dugald Jackson's, in which different values are given for the ratio expressing the distance between the axes and the diameter of the cylinders (Fig. 14).

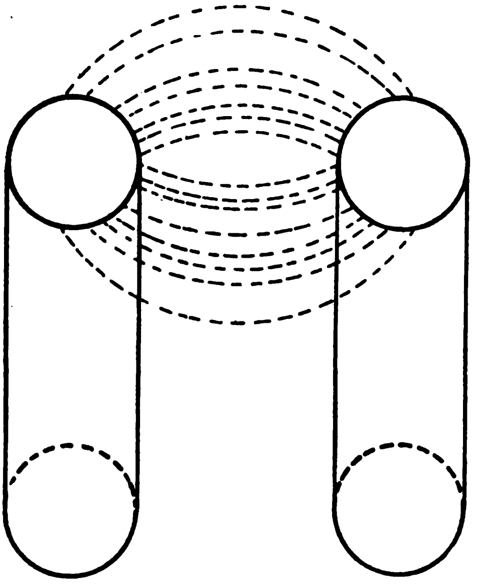


FIG. 15.

Table showing the magnetic reluctance in C.G.S. units between unit lengths of two equal parallel cylinders, Fig. 15, surrounded by air and having various values of the ratio $\frac{b}{d}$.

$\frac{b}{d}$	Reluctance per cm.	$\frac{b}{d}$	Reluctance per cm.	$\frac{b}{d}$	Reluctance per cm.
1.25	.19	4.	.655	7.5	.86
1.50	.30	4.5	.67	8.	.88
1.75	.337	5.	.73	8.5	.90
2.	.42	5.5	.76	9.	.92
2.5	.50	6.	.79	9.5	.94
3.	.556	6.5	.815	10.	.96
3.5	.61	7.	.84		

Alfred E. Wiener has ingeniously combined the results of many investigators and produced a table, in which the leakage value for a great number of machines is given.

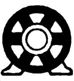
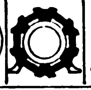
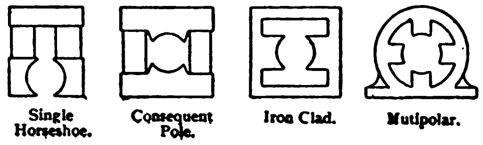
CAPACITY IN KILO WATTS	FACTOR OF MAGNETIC LEAKAGE, λ															CAPACITY IN KILO WATTS
	1 UPRIGHT HORSESHOE TYPE	2 INVERTED HORSESHOE TYPE	3 HORIZONTAL HORSESHOE TYPE	4 SINGLE MAGNET TYPE	5 VERTICAL DOUBLE MAGNET TYPE	6 HORIZONTAL DOUBLE MAGNET TYPE	7 BIPOLAR IRON CLAD TYPE	8 VERTICAL DOUBLE HORSESHOE TYPE	9 HORIZONTAL DOUBLE HORSESHOE TYPE	10 FOURPOLAR IRON CLAD TYPE	11 SINGLE MAGNET MULTIPOLAR TYPE	12 RADIAL MULTIPOLAR TYPE 	13 INNER-POLE TYPE	14 TANGENTIAL MULTIPOLAR TYPE 	15 AXIAL MULTIPOLAR TYPE	
1	2·00	1·75	……	1·90	……	1·50	1·50	……	……	……	……	……	……	……	……	·1
·25	1·80	1·60	……	1·75	2·00	1·40	1·40	……	……	……	……	……	……	……	……	·25
·5	1·70	1·50	2·00	1·65	1·90	1·35	1·35	1·80	1·90	……	……	……	……	……	……	·5
1	1·65	1·45	1·90	1·00	1·80	1·30	1·30	1·70	1·75	……	……	……	……	……	……	1
2·5	1·60	1·40	1·80	1.55	1.70	1·28	1·28	1.60	1·65	1·75	1·60	1.50	1·40	1·90	2·00	2.5
5	1·55	1·35	1·75	1·50	1·65	1·25	1·25	1·55	1·60	1·65	1·50	1·40	1·35	1·80	1·90	5
7·5	1·50	1·30	1·70	1·45	1·60	1·22	1·22	1·50	1·55	1·60	1·45	1·35	1·32	1·70	1·80	7.5
10	1·45	1·28	1·65	1·40	1·55	1·20	1·20	1·45	1·50	1·55	1·40	1·32	1·30	1·65	1·70	10
25	1·40	1·25	1·60	1·35	1·50	1·18	1·18	1·40	1·45	1·50	1·35	1·30	1·28	1·60	1·65	25
50	1·35	1·22	1·55	1·32	1·45	1·15	1·15	1·35	1·40	1·45	1·30	1·28	1·25	1·55	1·60	50
100	1·30	1·20	1·50	1·30	1·40	1·12	1.12	1·30	1·35	1·40	1·25	1·25	1·22	1·50	1·55	100
200	1·25	……	……	……	……	……	……	……	……	1·38	1·22	1·22	1·20	1·45	1.50	200
300	1·20	……	……	……	……	……	……	……	……	1·35	1·20	1·20	1·18	1·40	1·45	300
500	……	……	……	……	……	……	……	……	……	……	……	1·18	1·15	1·35	1·40	500
1000	……	……	……	……	……	……	……	……	……	……	……	1·16	1·12	1·30	1·35	1000
2000	……	……	……	……	……	……	……	……	……	……	……	1·15	1·10	1·25	1·30	2000

TABLE OF LEAKAGE FACTORS FOR VARIOUS TYPES AND SIZES OF DYNAMOS.

The principle, it seems, that should be greatly observed in the design of frames is to use pole-piece and core as one, and have them as nearly in line as possible, so that if leakage does occur it is included under the second class of conditions—leakage between surfaces in the same plane.

Machines with radial poles and a common keeper or a horseshoe type, such as previously described, with the two cores diverging, should not have very great leakage, because with a varying magneto motive force we have in such cases a correspondingly increasing distance.

CHARACTERISTIC TYPES.



The last remarks rather suggested the possibility of there being impurities in the steel tending to affect its permeability; not only is this fact of consequence to foundry owners, who desire to supply the trade, but a more exact knowledge is of equal importance to the designer. By knowing the foreign elements that enter into its composition, the possibility of eliminating or reducing the one of greatest detriment to its high magnetic conductivity can, by proper experiment, be correctly determined. A series of tests have been performed by Max Osterberg and Melbourne Monroe, relative to the above matter, with satisfactory results. One sample of the steel contained less carbon, manganese, phosphorous and silicon than the other, but the same amount of sulphur.

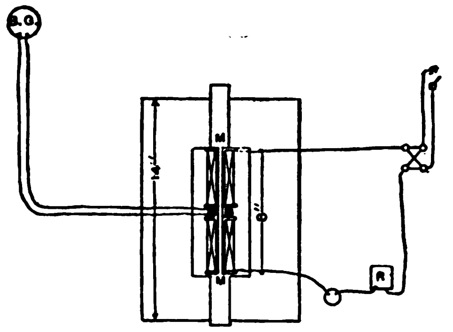


FIG. 16.

The samples were treated to four processes: annealing, hardening and annealing, hardening and plain. The tables they obtained by their experiments gave the values of the specific induction per square centimeter, the permeability, strength of field and flux per square inch.

The apparatus for determining the quantities about to be given consisted of a rectangular magnetic circuit through the center of which the bar to be tested, but cut in half, was placed; a small coil surrounded the bar at the middle, a greater coil on each side of it, and a spring was so adjusted that upon the removal of the upper portion of the bar the coil flew out, cutting all the lines of force in its path.

A d'Arsonval ballistic galvanometer, ammeter and various resistances completed the outfit. The greater coil, called by the experimenters the primary, consisted of from 900 to 2,000 turns with a range of current varying from .07 to 6 amperes. The secondary was composed of 90 turns wound on an appropriate spool and properly attached to the spring. The sketch shows the general principle of connections, magnetic circuit, etc. (See Fig. 16.)

ARTIFICIAL LOADING OF ALTERNATING-CURRENT MACHINERY.*

BY RUDOLF GOLDSCHMIDT.

An important point in the determination of the capacity of an electrical machine is the heating factor at full load and at overload. When the machines dealt with are not too large, it is generally possible to carry out a continuous full-load test without trouble in the ordinary works test-room.

One will naturally try to accomplish this with as little expenditure of power as possible, and can usually effect this by connecting the machine under test in circuit with the power mains. With alternate-current generators and transformers, loading with wattless currents is an additional and convenient method. Such methods, with their numerous variations, might well be more generally known. It is essential in these cases that a machine of sufficiently large capacity to take up the output of the machine under test shall be obtainable. On this account difficulties often arise in the testing of abnormally large machines.

For the ordinary characteristic tests (open circuit, short-circuit) from which the electrical performance of alternate-current machines can be sufficiently accurately determined, no machine to take up load is necessary, and even with the largest machines only relatively small amounts of power are required. If satisfied with the same degree of accuracy in the heating test, it is possible to obtain that also without a load machine, and with the least possible expenditure of energy. In order that the machine under test need not be loaded, even with wattless current, the EMF. induced in the working winding must have no part in the production of the current. The following method is based on this consideration: The iron must be worked under its normal conditions by running the machine at full voltage unloaded, and the copper must be heated by passing the normal current from some external source through the winding. As a heating current, continuous current deserves the first place. It is, of course, not possible to obtain the heating current by connecting a continuous-current machine or a battery direct to the terminals of a fully excited alternator. One must, naturally, so arrange matters that the continuous-current machine can pass current into the alternator windings without itself being able to take current from the latter. As a second condition, the continuous-current machine must not be able to cause any disturbance or damage to the alternator. With closed windings—as, for instance, three-phase ones with △ coupling—the test can be carried out without further trouble. The winding must be broken at some point *a a'* (Fig. 1), and closed again through the continuous-current source. The three branch voltages, E_1, E_2, E_3, cancel one another. Of course, the third harmonic components of these voltages add up with regard to $a\ a^1$, so that quite a considerable difference of potential may exist between *a* and *a'*.* In spite of this, however, the currents set up in the closed circuit from this cause are practically nil, since the reactances of the three limbs coupled in series offer an extremely high resistance to such internal currents at three times the frequency. One should therefore connect the continuous-current supply before exciting the three-phase alternator, and there is then nothing to fear. When testing high-tension machines the goodness of whose insulation is questionable, one should connect one pole of the continuous-current machine to the frame in order to protect its winding. The continuous current in the three-phase armature does not produce any reaction on the field magnets, since the three-phases traversed by currents in the same direction cancel one another. Only local magnetic fluxes can result. In fact, the armature winding forms poles three times as numerous as the field poles (Fig. 2). One might expect that these fields would induce powerful eddy currents in the pole-pieces. This is, in actual practice, not the case. The leakage of the local fluxes and the frequency of the eddy currents is too considerable, and the armature ampere-turns on modern machines are relatively too small to allow appreciable eddy currents to be induced in the pole-shoes.

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*Translated from the "Elektrotechnische Zeitschrift" for the "Electrical Engineer," London.

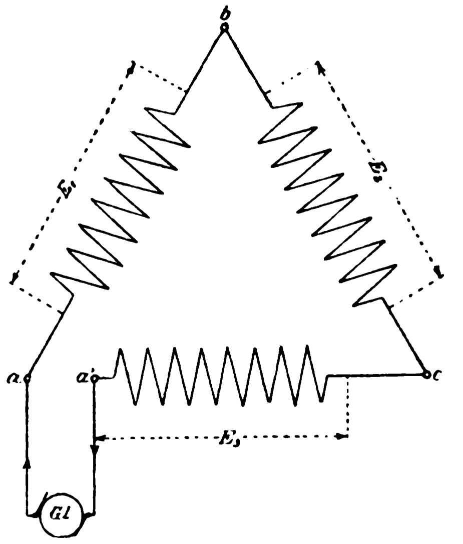

FIG. 1.

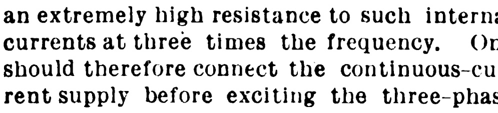

FIG. 2.

The natural consequence of the absence of armature reaction is that the field exciting current is too low, and that certain field distortions, principally due to the cross-magnetizing action of the power current, do not appear. The exciting current in our case is practically the same as that required for non-inductive full load. The heating of the field winding on inductive load can be determined by proportion, since, within the limits under consideration, the temperature rise may be taken as proportional to the expenditure in watts. If one estimates the increase in hysteresis loss through field distortion, either by theoretical considerations or by the help of tests on similar smaller machines, one can allow for it in the heating test by a definite increase in the excitation. The field ampere turns will be increased by the armature ampere turns by a certain percentage which is almost entirely dependent on the pole spacing.

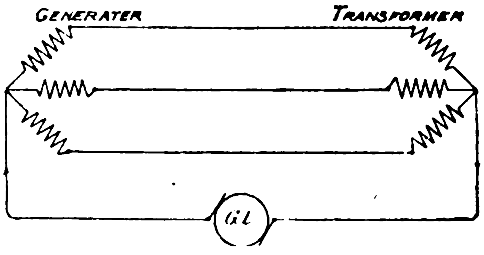

FIG. 3.

The continuous-current machine supplying the armature winding has only the copper losses to deal with, and therefore has to supply only about 1 or 2 per cent. of the three-phase output. The provision of the necessary low-voltage heavy current continuous-current machine for the testing of low-voltage three-phase generators is a matter of some inconvenience. If a suitable machine is not forthcoming, it is possible to utilize the short-circuit current of a higher voltage continuous-current machine. This can generally be increased to from 1½ to 2 times the normal current, continuously. Very often the exciter is suitable for the supply of the armature current. The armature resistance of the three-phase generator increases with the increasing temperature, so that a constantly increasing continuous current voltage is necessary in order to maintain the armature current constant. This voltage is at the same time a direct measure of the armature temperature rise.

If the armature of the three-phase machine is star coupled, it will be necessary to alter it into triangle coupling temporarily for the test, for, without special arrangements, the method only lends itself for the testing of closed windings. One can, however, retain the star coupling if a transformer of the same load and voltage as those of the three-phase machine is obtainable. The transformer should be connected to the generator terminals, and the continuous-current source should be coupled between the two neutral points (Fig. 3). In this way the transformer is also loaded, but a continuous current must at the same time be passed through the secondary winding, which must be triangle coupled. This current may either come from the same source as that supplying the primary winding, or, if the electrical conditions do not suit, from a separate source. Should one wish to employ this coupling for the general testing of transformers, it will be necessary to have a generator of equal power to the transformer. In order to make a smaller three-phase source do, however, it will be preferable to connect the primary also in triangle. In this case, however, it will be necessary to protect the three-phase generator from the continuous current by the insertion of resistances (Fig. 4). The drop of alternating voltage in these resistances is negligible on account of the small transformer no-load current. For the same reason one can, without danger, connect the continuous-current source into one of the primary branches. No want of symmetry in the voltages need be feared. If the transformer winding is subdivided into a number of separate coils, one can do away with the safety resistances by connecting the primary in two parallel groups with two separate neutral points, between which the continuous-current source is connected (Fig. 5).

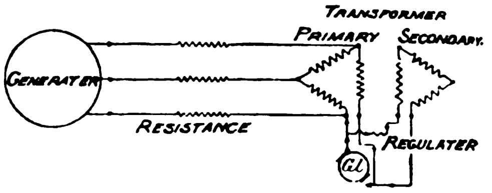

FIG. 4.

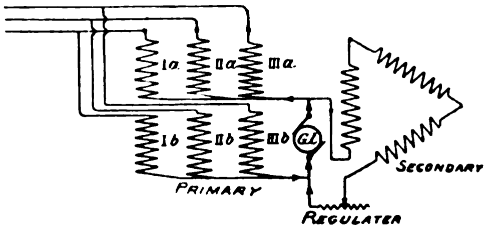

FIG. 5.

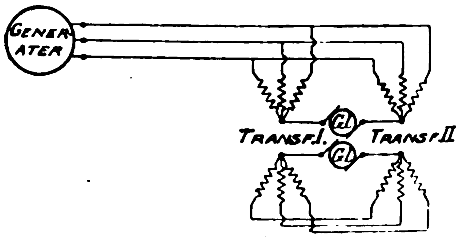

FIG. 6.

The transformer must then be supplied at half voltage. For the loading of two or more similar transformers no safety resistances or recoupling are necessary. All the windings should be star connected, and the two transformers should be connected in parallel both on the primary and secondary sides. The continuous current can then be brought in at the two neutral points (Fig. 6).

It is often convenient, in order to employ only one source of continuous current, to connect the two secondary (low volt) windings in triangle and in series with one another (Fig.

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*With alternate pole types this voltage is from 9 to 15 per cent. of the branch voltage, according to the slot and pole spacing, indicating a 3 to 5 per cent. third harmonic component.

7). The above method of loading transformers is, as far as heating is concerned, exactly equivalent to real loading, since the continuous current in the windings does not magnetize the iron.

Induction motors do not lend themselves conveniently to this method of loading. In the case of these, it should only be necessary to supply the continuous current to either the rotor or the stator (the connections corresponding to Fig. 5). If, for instance, we pass a continuous current through the rotor by connecting the neutral point of the latter to the frame

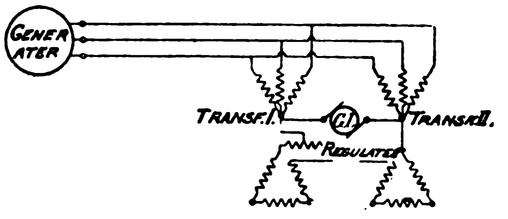

FIG. 7.

and coupling the continuous current generator between the frame and the slip rings, a stationary field will be set up in the rotor having three times as many poles as the main field (see Fig. 2). If, now, the primary winding is triangle coupled, the continuous-current field of the rotor will induce an alternating current, circulating within the triangle only. Unfortunately, the primary current corresponding to normal rotor current is only equal to $\frac{1}{\sqrt{2}}$ times the power component of the full-load current + the open circuit current (geometrically added). These results have been approximately confirmed by experiment.

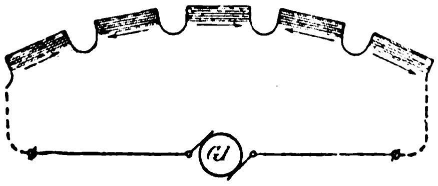

FIG. 8.

It is only in quite special cases (coil windings which can readily be recoupled) that single-phase generator armatures can be heated from an external source. In order to allow of this, alternate coils must be coupled in opposition (Fig. 8), so that the terminal voltage is nil, and the continuous current source can be connected to them without danger. With single-phase transformers it is only necessary to couple two parts of the winding in opposition, an alteration which is easily accomplished. Loading by continuous currents can be combined with alternate current loading—e.g., in cases where the latter is insufficient to give full load, it can be helped out by continuous current. The method has repeatedly been found of great use in the testing department of the Elektricitätz Actien-Gesellschaft vorm. Kolben und Co.

An Electric Light Argument.

From the London Science Siftings.

That the amount of oxygen in a room is decreased alarmingly by our methods of illumination the following simple statements show: A man may exist for an hour in a fair-sized room hermetically sealed if he has no light burning. Place a lighted candle in that room with him, and his existence will be shortened by 15 minutes. If he had a lamp instead of a candle in order to make himself more comfortable with additional light, he would live only half an hour. If he had two good gas burners he would scarcely have time to make his will, for he would not live more than five minutes.

Wireless News Over Channel.

LONDON, Dec. 28.—Arrangements have been entered into between the Marconi Company and the London and Brighton Railway and the corresponding French Railway Company to have a wireless telegraph system permanently installed between Newhaven and Dieppe.

The departure of boats will be signaled, with instructions as to the amount of luggage, number of passengers and other useful information, and it will no longer be necessary for the friends of the passengers to wait hours at either end when fog has delayed the boats starting.

Messages which have now to be sent via London and Calais have been known to take three hours in transmission. Both time and expense will thus be saved by the Marconi installation.

BOOKS RECEIVED.

ELECTRICAL ENGINEER'S POCKET-BOOK. By Horatio A. Foster. Published by D. Van Nostrand Company, New York. Bound in leather. Price $5.

This work, which is intended to be carried in the pocket, should prove to the great body of electrical engineers what Trautwine has been to civil engineers. In fact the two books look very similar, with the exception of color, and are about the same size. As the preface states, the book is not an encyclopedia, nor is it intended for a text-book, but it contains a compendium of useful data that should prove of untold value to the practising electrician and engineer. Some idea of the scope of the work may be obtained when it is stated that the following subjects are thoroughly treated: Symbols, Units and Instruments; Resistance, Electrical Measurements; Cable Testing; Conductors (properties of, relation and dimension of); Electric Lighting; Lighting Arresters; Electric Street Railways; Storage Batteries; Telephony; Magnetic Properties of Iron; Electromagnets; Determination of Wave Form; Electricity Meters; Dynamos and Motors; Dynamos and Motors Standard and Test; Static Transformers; Telegraphy; Switchboards and Switching Devices; Transmission of Power; Electricity in U. S. Navy; Certain Uses of Electricity in U. S. Army; Electro-chemistry and Electro-metallurgy; Electric Heating, Cooking and Electric Welding; Mechanical Section; Lightning Conductors; Miscellaneous Section; Underwriters' Code.

ELECTRICAL CATECHISM. By Geo. D. Shepardson, M. E. Published by the American Electrician Company, New York. Bound in cloth. Price $2.

This work, which contains some 400 pages of matter, is fully illustrated and is intended to answer the numerous questions that continuously come up in the minds of those who come into contact with any application of electricity. The writer has aimed to present in simple, non-technical language the information sought by electrical workmen, superintendents, engineers, dynamo tenders, wiremen, motormen and others, and that he has succeeded in compiling a most valuable work is clearly proven by a glance at the reading matter.

PRACTICAL ELECTRIC RAILWAY HAND BOOK. By Albert B. Herrick. Published by the Street Railway Publishing Company, New York. Bound in leather. Price $3.

What Searles' has in the past proven to the steam railroad engineer this work should prove to the electric street railway engineer. The book contains a little over 400 pages with many illustrations and deals with everything of interest to a man engaged in street railway work; In it the author has collected an immense amount of valuable data, applicable in the construction, testing or operation of electric railway systems, showing such appliances, structures and methods as have been adopted in practice by street railways in the United States. Persons interested in this branch of the industry should have the work.

OUTLINES OF ELECTRO-CHEMISTRY. By Harry C. Jones. Published by the Electrical Review Publishing Company, New York. Bound in cloth. Price $1.50.

This work, which contains about 100 pages of reading matter, is devoted to a subject on which there are as yet comparatively few books of value. As the author states over his signature the book does not pretend to be a systematic treatise on electro-chemistry, but takes up several of the most important chapters in electro-chemistry and deals with them more or less fully. For instance, the theory of electrolytic distribution is discussed, electrolysis and theories of electrolysis are touched upon, while another chapter is devoted to the conductivity of solutions. The work is well worth the price asked.

CONDUIT WIRING AND ERECTION. By L. M. Waterhouse, A. M. Inst. C. E., A. M. Inst. E. E. Published by S. Rentell & Co., London, W. C. Price 50 cents.

This little work contains some 75 pages of interesting matter referring to the Simplex System of Steel Conduits. The author sets forth in a most clear and concise manner the best and most economical methods of erection and plans for wiring. The methods are fully illustrated as well as the various sections of the conduits.

A B C OF THE TELEPHONE. By James E. Homans, A. M. Published by Theo. Audel & Co., New York. Bound in cloth. Price $1.

This book contains about 330 pages of matter of great interest to workers in the telephone field. It is profusely illustrated, which aids in making clear the construction and operation of telephonic apparatus. While giving a distinct idea of the contrivances employed in practical telephony, together with points on construction, this book enters into technical details no more than is positively necessary to insure an understanding of the subject. It is intended for the use of all persons desirous of obtaining an adequate idea of the practical operation of the telephone industry; how the impulses of the voice are transmitted by the electric current; how telephonic connection between two lines is made at the exchange, together with the various devices there employed for expediting the operation; and the most approved methods of constructing telephone lines and insuring thorough conduction of the telephonic currents. The subject of private intercommunicating telephone systems is also fully treated, being illustrated with diagrams of wiring, containing descriptions of the most practical switching devices, and numerous representations of specially constructed apparatus.

American Institute of Electrical Engineers.

The 159th meeting of the Institute will be held at the house of the American Society of Mechanical Engineers, 12 West 31st street, New York, and at the rooms of the Western Society of Engineers, Monadnock Building, Chicago, Friday evening, January 3, at 8:15 o'clock.

On account of the regularly announced date of this meeting occurring during holiday week the Committee on Papers with the concurrence of the president authorized its postponement from December 27th to the above date.

The general subject of the meeting will be "Methods of Illumination and Units of Light," with an introduction by President Steinmetz. The following papers will be presented:

"Methods of Illumination," by Dr. Louis Bell, of Boston.

"Illumination and Units of Light," by Mr. W. D'A. Ryan, of Lynn, Mass.

"The Incandescent Lamp of To-day," by Mr. John W. Howell, of Harrison, N. J.

"Electric Gas Lamps and Gas Electrical Resistance Phenomena," by Mr. P. Cooper Hewitt, of New York, illustrated with apparatus.

"The Present Status of the Question of a Standard of Light," and "Note on an Acetylene-in-Oxygen Flame," by Dr. Clayton H. Sharp, of New York.

Applications have been received from the following candidates for the grade of associate which will be acted upon at the meeting of the Board of Directors, January 24, 1902: Sewall Cabot, Boston, Mass.; Ward S. Arnold, Chicago; W. D'A. Ryan, Richard Fleming, Lynn, Mass.; William V. Graham, Syracuse, N. Y.; Samuel Martin Kier, Pittsburg, Pa.; Cornelius D. Ehret, Walter H. Whiteside, Henry H. Seabrook, Washington, D. C.; Shiro Yamazaki, Ithaca, N. Y.; William Van Amberg Sullivan, Jr., Sitka, Alaska; Max Touret, Paris, France; Fred. A. Jones, Willits H. Sawyer, Schenectady, N. Y.; Harry O. F. Bindeman, Berlin, Germany; Henry E. Warren, Newton Centre, Mass.; Eugene W. Caldwell, Max von Recklinghausen, Albert S. Terry, Ray D. Lillibridge, Isaac D. Parsons, James Dixon, New York City; Merwyn Paul Randolph, Seattle, Wash.; Howard L. Blackwell, Cambridge, Mass.; Carl L. Morgan, Boston, Mass.; Willis L. Adams, Niagara Falls, N. Y.

The next meeting will be held on Friday, January 24. Subject, "Data and Methods of Determining Acceleration and Braking Effects, and Other Problems Involved in Electric Railroading."

Proposals Invited.

The Interior Department, through the Commissioner of Indian Affairs, is inviting sealed proposals until January 24, 1902, for furnishing and delivering the necessary materials and labor required to construct and complete the steam heating and electric lighting plants at the Fort Totten School, North Dakota. Detailed information will be furnished intending bidders upon application to Chas. L. Davis, superintendent of the school.

* * *

The Japanese Minister at Seoul has notified the Corean Government that Japan has begun the erection of wireless telegraph stations along the Corean coast.

PERSONAL MENTION.

Prof. F. B. Crocker, who has been spending his holiday vacation in Cuba for the purpose of shaking off a severe cold, is expected home this week.

Mr. Henry Floy, the well-known electrical engineer, is now connected with the Atlanta (Ga.) Electric Power Company.

Mr. A. M. Fisher will supervise the department for the export of machine tools that Messrs. Browne & Frothingham of 32 Broadway, New York City, have recently opened. Mr. Fisher lately returned from Japan where for three years his entire attention was devoted to this branch of engineering.

Mr. Jilson J. Coleman, general manager of the Trenton, Lawrenceville & Princeton (N. J.) Railway Company has returned from his recent extended stay in the West, and will immediately resume the active management of the Johnson interests in that locality.

"The Four-Track News."

"The Four-Track News" is the latest addition to New York Central Railroad literature. It is a neat, illustrated pamphlet, published under the direction of George H. Daniels, General Passenger Agent, and resembles in form the publications of the "Four-Track Series," of which it is called a sequel.

"The Four-Track News" will be published monthly, and will contain timely notes of travel, interesting information relating to transportation and its development and brief notes on books of travel. An interesting item in the little book is the account of the growth of the New York Central Lines from 1831 to the present time. In that year the company owned seventeen miles of railroad, the primitive locomotive De Witt Clinton and three Concord stages transformed into cars. The system now controls 10,453 miles of road.

Copies of the "Four-Track News" may be obtained from Mr. Daniels' office by sending a two-cent stamp.—From the New York "Tribune."

INCORPORATIONS.

The Monmouth County Electric Company, Trenton, N. J.—to operate an electric railway system in Monmouth County. Capital stock, $500,000.

The Montgomery County Subway Company, Norristown, Pa.—to engage in the purchasing, leasing, etc, of pipes and tubes for carrying electric wires, etc., underground. Incorporators: John T. Dyer, Samuel K. Anders and F. G. Hobson.

The Electrical Construction & Maintenance Company, St. Louis, Mo. Capital stock, $20,000. Shareholders: Van S. Penoyer, William H. McLaren and George D. Harris.

The Reynoldsville Light & Power Company, Reynoldsville, Pa. Capital stock, $20,000. Incorporators: H. Alexander Stoke, T. Cox Smith, Smith M. McCreaght, James Mulholland and John H. Burtop, all of Reynoldsville.

The Elizabeth City Electric Railway & Power Company, Elizabeth City, N. C. Capital stock, $20,000. Incorporators John G. Wallace, J. A. Wallace, W. C. Ferebee and C. M. Ferebee.

The Standard Motor Company, Kokomo, Ind. Capital stock, $20,000, Directors: W. D. Irvin, S. J. Myers, E. G. Shortridge, W. P, Sellers, G. C. Yowell, A. W. Holcomb and Jesse Haimes.

The Illinois Valley Railroad Company, Chicago—to operate electric light, heat power and railway plants. Capital stock, $300,000. Incorporators: Josiah Gratty, William H. Duval and Edward J. Hamel.

The Bristol Gas & Electric Company, New York City—to manufacture gas and electricity for illuminating and other purposes. Capital stock, $300,000. Directors: Benjamin L. Dulaney of Bristol, Tenn., and Anson McC. Beard, John D. Fearhake, Frank B. Pierce and Frank M. Wells, of New York City.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DEC. 24, 1901.

ELECTRIC RAILWAYS AND APPLIANCES.

689,545. Electric Railway. Charles Hansel, New York City, assignor to the Central Electric Construction Company. Filed Aug. 8, 1900.

689,615. Trolley-Wire or Other Conductor for Electric Traction. George E. Heyl-Dia, Warrington, Eng. Filed June 3, 1901.

689,653. Electric Tramway or Street-Railway. William B. Sayers, Glasgow, Scotland. Filed Jan. 21, 1901.

689,705. Car-Fender. Lucien Castin, New Kensington, Pa. Filed Oct. 18, 1901.

689,706. Electric Railway System. Baptistin Cruvellier, Paris, France. Filed May 3, 1901.

689,815–689,816. Electric Railway. George L. Fowler, New York City, assignor to the Central Electric Construction Company. Filed July 18, 1900. Renewed April 25, 1901.

ELECTRIC LIGHTS AND APPLIANCES.

689,387. Sectional Electric Light, Telephone or Telegraph Pole. William B. Crossland, Guthrie, Okla. Filed June 24, 1901.

ELECTRICAL MACHINERY AND APPARATUS.

689,445. Rheostat. Charles Wirt, Philadelphia, Pa. Filed Oct. 13, 1900.

689,452. Electric-Circuit Controller. William K. Bassford, Jr., Bound Brook, N. J. Filed June 8, 1901.

689,458 Lock for Electric Controllers. William K. Bassford, Jr., Bound Brook, N. J. Filed June 8, 1901.

689,483. Magnetic Engine or Motor. Raymond R. Gilman, Melrose, Mass., assignor of one half to Charles J. Groves, Boston, Mass. Filed May 23, 1901.

689,830. Limiter or Interrupter for Electric Circuits. Ralph J. Patterson, Woburn, Mass., assignor of one half to L. R. Wallis, Winchester, Mass. Filed Dec. 29, 1900.

689,836. Electric Cut-Out. Alden D. Wheeler, Hyde Park, Mass., assignor to the Gamewell Fire Alarm Telegraph Company, New York City. Filed March 2, 1901.

TELEPHONES AND TELEPHONE APPARATUS.

689,503. Electric Telephone Transmitter. Alfonso M. Massari, Rome, Italy. Filed Feb. 18, 1899.

689,631. Telephone Indicator. Samnel J. Ballard, Los Angeles, Cal. Filed April 11, 1900.

MISCELLANEOUS.

689,380 Means for Electrically Controlling Gas-Cocks. Hugo Borchardt, Berlin, Germany. Filed May 28, 1901.

689,406. Electric Exercising Apparatus. Alfred Olsen, San Diego, Cal. Filed April 1, 1901.

689,415. Electric Telegraph. Henry A. Rowland, Baltimore, Md; Henrietta H. Rowland, administratrix of said Henry A Rowland, deceased, assignor to the Rowland Telegraphic Company, same place. Filed March 11, 1901.

689,417. Electric Truck. Thomas F. Rowland, New York City. Filed May 29. 1901.

689,426. Portable Telegraph Key. Charles Shirley, Brooklyn, N. Y., assignor of one-half to John F. Skirrow, East Orange, N. J. Filed July 11, 1901.

639,438. Interrupter. Thomas W. Topham, Brooklyn, N. Y. Filed July 30, 1901.

689,456. Voltaic Cell. Harry S. Amwake, Camden, N. J. Filed Feb. 9, 1901.

689,457. Electric Igniter for Explosive Engines. Jean D. Boisselot, New York City, assignor to Eduard Van Dane, same place. Original application filed Oct. 11, 1900. Divided and this application filed Jan. 2, 1901.

689,489. Electrical Device. Samuel C. Harris, New York City. Filed March 28, 1901.

689,541. Conduit for Electric Wires or Cables. Thomas Cunningham, Wenham, Mass. Filed Dec. 26, 1899.

689,561. Means for Magnetically Separating Different Substances from Each Other. Charles F. McKenna, New York City. Filed Dec. 7, 1896.

689,566. Apparatus for Transforming Single and Multiphase Alternating Currents into Continuous Currents and Inversely. Raymond Rouge and Georges Faget, Paris, France. Filed April 6, 1900,

689,613. Electric Cable and Process of Manufacturing Same. George E. Heyl-Dia, Warrington, Eng. Filed May 16, 1901.

689,614. Apparatus for Covering Electric Conductors with Insulation. George E. Heyl-Dia, Warrington, Eng. Filed June 3, 1901.

689,683. Electric Elevator. Joseph W. Moore, Newton Highlands, Mass. Filed June 17, 1901.

689,711. Electric Visual-Signal Apparatus. Rudolf Einbigler, New York City. Filed March 1, 1901.

689,753. Multiplex Printing-Telegraph. Henry A. Rowland, Baltimore, Md., assignor to the Rowland Telegraphic Company, same place. Filed July 26, 1897.

689,754. Page-Printing Machine. Henry A. Rowland, Baltimore, Md., assignor to the Rowland Telegraphic Company, same place. Filed Dec. 29, 1899.

689,776. Electric Battery. Thomas J. Bain, Cairo, Ill. Filed July 8, 1901.

689,826. Automatic Compensatory Electric Reel. Ralph L. Montagu, Oroville, Cal., assignor of one-half to Benjamin Stanley Revett, Breckenridge, Col. Filed Oct. 17, 1900.

DESIGN.

35,462. Insulator for Electric Wires. Theodore F. King, Nashville, Tenn. Filed Sept. 21, 1901. Term of patent 14 years.

THE TELEPHONE WORLD.

To Reorganize Erie Telephone Company.

Details of a plan for the reorganization of the Erie Telegraph & Telephone Company, with a capital of $32,000,000, involving a transfer of control to the American Telephone & Telegraph Company, are made public in a circular to the shareholders of the former company. Kidder, Peabody & Co., bankers, will carry out the plan if it is accepted by the shareholders.

That the step will be taken is thought to be assured, in view of the statement in the circular that the financial condition of the company is "critical" and the declaration that $9,000,000 in notes, with interest from July 10, 1901, at 5 per cent. per annum, fall due January 10, 1902, while the company has on hand to meet these maturing notes "no cash or securities upon which cash can be raised, nor any other available resources, and it will therefore be unable to pay them."

The circular also refers to the necessity of spending on subsidiary companies $6,000.000, which amount the Erie is unable to furnish. The reorganization plan involves the formation of a new concern with $16,000,000 in preferred stock, to be 6 per cent. and cumulative after two years from issue, and $16,000,000 common stock. The par value of each will be $100. This stock will be subject only to an indebtedness of $10,000,000 in gold bonds.

To the 1923 and 1929 bondholders of the present company are offered $900 worth of 5 per cent. bonds of the new company, due in 1932, and two shares of preferred stock for each $1,000 bond of the present company. The 1909 and 1926 bondholders of the present company are to get $1,050 worth of 5 per cent. bonds, due in 1932, for each $1,000 bond of the present company.

Present stockholders may purchase preferred and common stock, in the new company, upon payment of $25 per share of the present stock; each holder of four shares to receive one share of preferred stock and three shares of common stock in the new concern.

The Danville, Ia., Mutual Telephone Company filed articles of incorporation at the court house a short time ago. The object of the company is to conduct a general telephone business, etc., in Des Moines and adjoining counties. The company was organized on October 29, 1901, and is to continue for 20 years. The capital stock is $2,500. The annual meeting will be held on the first Tuesday in January. The present officers are: President, John Shepherd; vice-president, Port Mix; secretary, Woods M. Irwin; treasurer, R. P. Cody; manager, F. B. Williams.

The cold weather does not retard work on the line of the Rensselaer, N. Y., Telephone & Telegraph Company. Conduit building continues. It is expected that the company will be ready for service by the first of May next. An officer of the company stated not long ago that the complete equipment for the service in Troy and vicinity will cost $350,000, and that the switchboard, which is being built to accommodate 7,000 patrons will cost $20,000.

A line of telephone poles has been set from Townshend to Londonderry, Vt., by C. B. Alexander of Londonderry, who has bought the line from Townshend to Jamaica, which has not been in use for some time. Mr. Alexander will operate the line on a branch line contract with the New England Telephone & Telegraph Company, giving direct communication between Brattleboro and all points on the narrow-gauge railroad.

A copy of the article of amendment to the charter of the Colorado Telephone Company was lately filed for record in the office of the county clerk. The articles of incorporation of the company were amended at a meeting of the stockholders in Denver in December. The capital stock was increased from $3,000,000 to $5,000,000.

The directors of the newly formed Interurban Telephone Company of Utica, N. Y., are D. Clinton Murray, John D. Kernan, Frank L. Jones, John J. Town, J. Francis Day, Hugh White and Charles I. Williams.

A recent report from Maysville, Ky., says that the sheriff has sold telephone franchises over the leading turnpikes at auction. The Maysville Telephone Company bought all the franchises without opposition. The privilege is for 20 years, but is not exclusive.

The Dauphin County Telephone Company's construction gangs will have the lines ready in Harrisburg, Pa., to-day.

The Continental Telephone Company of Chicago has increased the number of directors from three to five.

Last week the Twin City Telephone Company opened its new toll lines to Cambridge and Rush City, Minn.

Inconvenience of Double Telephone Service in Baltimore, Md.

Baltimoreans are beginning to realize that there can be too much of a good thing, even in the matter of telephones, and many a fervent wish is being expressed that some way to alleviate the evils of the double service could be found. But at present no course is plain.

In proportion to its population, Baltimore has a larger percentage of telephones in actual use than most other cities, which fact would naturally redound to the credit of the city and the convenience of its inhabitants were it not for the fact that the number of telephones is divided between two companies. As a result there is much duplication.

When the old Home Telephone Company entered the field the competition was welcomed because there was a promise of lower rates and a better service. As long as the Chesapeake & Potomac Company had the field to itself, it steadfastly adhered to the practices of the Bell monopoly, gave a poor service at an almost prohibitive rate, fought the city at every turn, and apparently did everything in its power to prevent the service from becoming popular.

After the Home Company had failed and sold out to the Maryland Telephone & Telegraph Company, conditions speedily changed. The Chesapeake & Potomac Company found that it would be necessary to alter its tactics if it intended to continue in business.

At the present time the two companies have about an equal number of subscribers, each being credited with slightly less than 7,000 telephones in actual use. Neither company lays claim to more than 2,000 subscribers who use one telephone exclusively, and it follows, therefore, that about 5,000 firms, corporations or individuals, are using both 'phones.

At the beginning of its career the Maryland Company adopted a policy of low rates for good service, and has steadfastly adhered to this, even when it came into a position to compete successfully with the Chesapeake & Potomac Company in every section of the city. Its growth has been marvelous, thereby attesting the hold which it has upon the confidence of the people of the city, and it is making plans for the future, which, when carried out, will put it into a position to give the most general and satisfactory service Baltimoreans can get.

The Winona, Minn., Telephone Company has completed a thorough overhauling of the lines of the Phoenix Telephone Company, which it purchased early in the fall, and the system is now in first-class order. No more extensions will be undertaken until spring. The most important improvement made in Phoenix territory, aside from the placing of new switchboards at Lanesboro and Rushford, has been the construction of 14 new miles of line from Rushford to Highland. This greatly facilitates long-distance service by giving a direct line from Spring Valley to La Crosse.

A report from Cincinnati.O., asserts that the local telephone company has already started its solicitors out on the nickel service that is offered by the company at largely reduced rates, and the additional subscribers are already coming in great numbers. The new schedule of rates appears to have been warmly received.

The Dirigo Telephone Company was recently granted a petition which gives it the right to construct and erect poles, with cross-arms thereon, along and upon the several streets and highways of the city of Augusta, Me.

By the competition of the line of the New Brunswick Telephone Company in Maine from St. John to Calais, the Portland office is now brought into direct contact with the former city.

The Sunset Telephone Company of Seattle, Wash., has taken out a permit for the construction of a three-story addition to its present building on Third avenue. The addition will cost in the neighborhood of $14,000.

The Livingston, Mich., Home Telephone Company has elected as president R. Bruce McPherson; secretary, I. E. Gardner. The company has eight toll stations and 175 subscribers connected.

The Pike County Telephone Company of Pittsfield, Ill., has increased its capital stock from $20,000 to $35,000.

Nearly $3,000 worth of damage was done to the Oneida N. Y., Telephone Company's office at a recent fire.

The Union Telephone Company of Alma, Mich., has increased its capital from $200,000 to $250,000.

Telephone Intercommunication.

A somewhat novel arrangement has been made between the British Postoffice Department and the National Telephone Company, in connection with the telephone business of Great Britain. The Government started out to nationalize the service. It has ended by entering into a partnership with the National Telephone Company. The arrangement provides for intercommunication between the two systems, and fixes the rates for 'phones till the year 1905. The Government, apparently, has not been able to withstand the influence of the corporation, and a compromise is the result. In regard to this question the Toronto, Ont., "World" says: "The principle of intercommunication between different systems would be a good one to introduce in Canada. A law should be passed compelling one telephone company to receive and handle the business of another. If such a law were in force telephone companies would spring up all over the country. In many places where the Bell Telephone Company cannot be induced to start a service local capitalists would do so, provided they could secure a connection with the Bell system. There would be no straining of the law to compel the Bell or any other telephone company to furnish direct connection with any company desiring the same."

Laurens, S. C., has connection by telephone with the various parts of the county, except to the southwest, towards the Reedy River and Honea Path. Mountville has connection with Cross Hill and Clinton. The ground has been frozen, however, for about four inches deep for the last few days and work has been impracticable. From Honea Path to Tumbling Shoals, in Laurens, a distance of about 16 miles, a line is being constructed, in which W. D. Sullivan, T. J. Sullivan, Capt. J. B. Humbert, and other large planters are interested. The line will soon be completed. It is 12 miles from Laurens to Tumbling Shoals, and it is hoped that at an early day this missing link will be supplied by the business men of Laurens.

The Western Electric Company has completed its installation of the new switchboard in the Hartford, Conn., exchange office, and it is expected that the cut over of the old system to the new will be completed in the course of a couple of weeks. It is expected that no delay will follow the introduction of the new board The telephones of the city have been equipped with devices which permit of their use on both boards. As soon as the new board is in place new 'phones will be supplied subscribers by which no ringing of the bell is necessary to call the central office.

It is well assured that Concord, Tenn., will have a telephone exchange in the near future. F. E. Judson is looking after the matter, and as more numbers have already been secured, there is little doubt that the matter will be rapidly pushed and that the exchange will soon be established.

News from Washington says that the District Commissioners have received two additional applications from the Chesapeake & Potomac Telephone Company to string lines of aerial cable on Columbia Heights. These applications will be considered with a number of others affecting the same sub-division now before the board, and it is understood that they will be approved.

A new independent telephone company has been organized to operate between Prattsburg and Pulteney, N. Y. This company expects to work in connection with the one that now operates between the villages of Pulteney and Branchport.

The consolidated telephone line of Minnesota is building into Pine City.

TELEPHONE INCORPORATIONS.

The Princeton Telephone Company, Princeton, Ind. Capital stock, $25,000. Directors: John W. Ewing, Henry J. Krisel, Charles F. Stevens, L. W. Gudgel, Steele F. Gilmore, Vincent W. S. Trippett and William E. Stillwell.

The Athens Telephone Company, Lone Star, O. Capital stock, $2,000. Incorporators: R. M. McManagle, F. M. Wood, L. A. Rasson, B. D. Turner and S. J. Jeffers.

The Auburn Telephone Company, Auburn, Ky. Capital stock, $400. T. O. Helm is at the head of the company.

The Halleck Telephone Company, Rensselaer, Ind —to operate telephone lines in the counties of Jasper, Newton, Benton, White, Tippecanoe, Warren, Carroll, Cass, Pulaski, Starke, Fulton, Marshall, St. Joseph, Laporte. Porter and Lake. Capital stock, $10,000. Incorporators: Charles Halleck, John F. Brunner, Sarah A. Wells, L. I. Halleck, Nettie Joyner, Abraham Halleck and Elizabeth White.

The Mutual Union Telephone Company, Abingdon, Ill. Capital stock, $2,500. Incorporators: Leonard E. Cutler, William H. Beaver and others.

GENERAL ELECTRICAL NEWS.

Lighting.

Arvada, Col.—It now seems probable that this town will soon be lighted by electricity.

Brazil, Ind.—The electric light plant and all buildings connected with No. 2 mine, belonging to the Brazil Block Coal Company, were recently destroyed by fire. The loss is $25,000, with but $15,000 insurance.

Circleville, O.—An ordinance was lately read in the city council granting permission to Wm. Heffner, W. E. Crist, Frank Millspaugh, M. M. Lewis, B. F. Beford, W. K. Sater, T. E. Smith, Irwin S. Snider and Clarence Kirk to erect and maintain an electric light plant. The company will bear the name of the Circleville Light & Fire Company, and will be a rival to the electric light plant of this city.

Crewe, Va.—This place is soon to have an electric light plant.

Dayton, Tenn.—The Dayton Coal & Iron Company is reported as contemplating the construction of an electric plant at its mines, and may furnish a lighting supply to this city.

De Vall's Bluff, Ark.—The DeVall's Bluff Electric Light Company will soon have to increase its plant to meet the demands.

Eagle's Mere, Pa.—The dam at Hunter's Lake, which furnishes water power for the Eagle's Mere electric light plant, will be reconstructed and made larger to meet the extra demand for more lights to be supplied the coming season.

East Cleveland, O.—Mayor George H. Quay of this place wants to establish an electric lighting plant to be owned by the city.

Elmira, N. Y.—The electric light system of this city is to be almost entirely changed, new and more powerful lights to take the place of those now in use.

Friendsville, Md.—Electric lights will be installed in this place.

Harrisburg, Ill.—The city council has passed an ordinance granting the Harrisburg Water, Light & Power Company a franchise for 20 years for electric lights.

Holland, Mich.—The Grand Rapids, Holland & Lake Michigan Railway Company has been granted franchises in Holland Township and in the one adjoining, under which the company is permitted to supply electricity for lights to residents of these two townships.

Holland Patent, N. Y.—The board of trustees has appointed its president and clerk a committee to investigate the cost of installing an electric light plant in this village.

Holley, N. Y.—The Walden Exchange Bank has purchased $15,000 electric light bonds.

Kahoka, Mo.—Bonds to the amount of $12,000 have been voted to build a water and light plant.

Lake Linden, Mich.—The people are again talking of installing a municipal lighting plant.

La Salle, Ill.—This place is soon to have an electric light plant in operation.

Madison, Wis.—The Madison Electric Light Company's plant is soon to be equipped with two large gas engines, and if they prove successful the plant will dispense with steam as a generator of electricity.

McRae, Ga.—The citizens of this place have voted to issue bonds for a light and water plant.

Onawa, Ia.—The electric light plant of this place is to be enlarged.

Pond Creek, Okla.—John A. Lewis has received a franchise for the erection of an electric plant of 30 arc and 1,200 incandescent lights.

Pratt City, Ala.—The citizens are discussing the electric light question.

Richmond, Ind.—This city will try the experiment of municipal electric lighting, and now has under construction a $150,000 plant. It will probably be ready within three months.

Rogersville, Tenn.—The Rogersville electric plant, rned recently at a loss of $4,000, may be rebuilt.

Searcy, Ark.—Waterworks and an electric light plant will be installed here. Address John V. Roberts, mayor, for further information in relation to same.

Tampa, Fla.—West Tampa will decide the question of issuing $10,000 electric light bonds January 7.

Timpson, Tex.—Electric lights will be installed here in the near future.

Warren, O.—The Abbott Electric & Novelty Company. will build a $60,000 plant in this city.

White Lake, S. D.—The citizens have decided to have the streets lighted with electricity.

White Plains, N. Y.—The certificate of incorporation of the Hudson Valley Light & Power Company was recently filed in this place. It is to furnish electric lights for the villages of Ossining, North Tarrytown, New Castle, Greenburg, North Castle, Mount Pleasant and other villages and towns in Westchester County. The capital stock is $25,000.

Street Railways.

Albion, N. Y.—The Albion Electric Railway Company has been formed, to operate an electric road three miles long in this place, with a capital of $30,000.

Ballston Spa, N. Y.—The Ballston Terminal Railroad has been granted a franchise to construct an electric railroad on certain streets of Gloversville.

Cedar Rapids, Ia.—The people of this place anticipate that within the next year their city will be the center of the most extensive systems of rural trolley lines in the country.

Elgin, Ill.—There are prospects that the electric line will be extended from Yorkville to Plano.

Elizabeth, N. J.—United States Senator John Kean, Gov. Foster M. Voorhees, Hamilton F. Kean and Frank Bergen are at the head of a trolley company recently organized in this city. The company's plans include an entire system connecting Newark, Elizabeth, Plainfield and Perth Amboy with the towns along Staten Island Sound and the summer resorts along the coast.

Fredonia, N. Y.—A petition was lately received by the village board from the Lake Shore Traction Company, newly organized, for a franchise to lay tracks, switches, etc., through the village on Main street.

Indianapolis, Ind.—A report is current here that Hugh J. McGowan, president of the Indianapolis Street Railway Company, is prominent among the men who are behind plans for a trolley system to connect New York and St. Louis. The scheme, it is reported, is even broader in scope than that of the great Everett-Moore Syndicate, whose system is being extended to connect all of the principal cities on the Great Lakes.

Mankato, Minn.—The railroad committee of the board of trade has received a proposition from Col. W. H. Chase, who is promoting a proposed electric railway line from here to St. Cloud via Henderson.

Monticello, N. Y.—The trolley road between here and Fallsburg is to be built by July 1, 1902, or the contractors forfeit $5,000.

Newcastle, Ind.—The county commissioners have granted a franchise to the Muncie, Middletown & Greenfield Electric Railway Company. The line will run from Delaware County south to Shirley. This makes four franchises granted to interurban companies in Henry County.

New Haven, Conn.—Work will begin in a few days on the New York, New Haven & Hartford Railroad Company's improvements of the third-rail system between Hartford and Bristol, about 19 miles. Much stronger voltage machines are to be placed in the Berlin power-house, heavier copper wire installed, and at Hartford, New Britain and Bristol will be placed substations with transformers. The third-rail is to be improved, the outer rails rebonded, and the cars geared for higher speed.

Owenton, Ky.—Initial steps have been taken for the building of a steam or electric railway between this city and a point on the Louisville & Nashville Railroad—Sparta or Sanders. Abundance of capital is behind the enterprise. The promoters are ex-Congressman J. W. Gayle, Attorney William Lindsay, Florian Cox, W. S. Gayle and County Clerk W. P. Swope.

Pecatonica, Ill.—The village board met in a recent special session and adopted an ordinance which, if agreed to by the directors of the Rockford-Freeport electric line, will give them a franchise through the territory of the village.

Saginaw, Mich.—The Saginaw Suburban Electric Railroad Company has been reorganized so as to take in Flint capital. George Silsby is president, Col. O. Russ vice-president, E. D. Black secretary and A. G. Bishop treasurer.

Stoughton, Wis.—The granting by the city council of the 50 year franchise to the company headed by P. L. Spooner, the Madison-Janesville interurban trolley system is practically assured.

St. Joseph, Mo.—In all probability the entire system of the St. Joseph electric lines will pass into the hands of other owners. They are now owned by a syndicate headed by E. H. Harriman of New York. President W. T. Van Brunt was called to New York to consult with men who are to make the purchase, and his report, it is announced, has been favorably acted upon.

Washington C. H., O.—A traction line will soon be built between Springfield, O., and this city by the Springfield & Washington C. H. Traction Company. Secretary O. F. Dillman of Dayton, O., is connected with the enterprise.

Wilmington, Del.—Water is to furnish power for the operation of electric cars of the Wilmington City Railway Company, and the old Brandywine is to be harnessed in order to afford the supply.

Manufacturing.

Buffalo, N. Y.—The Clifton Manufacturing Company of Hyde Park, Mass., proposes to erect a factory in this city for the manufacture of insulated tubes, which will mean the employment of at least 100 men. This company sells insulated steel and iron tubes for gas and water mains, electrical wires and other subterranean conduits.

Cincinnati, O.—A contract for electrical machinery has been awarded to the Bullock Electric Manufacturing Company by the Allis-Chalmers Company, which calls for $40,000 worth of machinery to be used in the Milwaukee plant, on which several millions of dollars are to be expended in the next year or so. The machines to be placed in by the Bullock Company will be direct-connected motors for running some of the larger tools.

Company Matters.

Asbury Park, N. J.—The partnership existing between W. A. Morse and Hermen Stein, trading as the Morse Electrical Construction Company, is about to be dissolved.

Chicago, Ill.—The Monarch Electric & Wire Company has increased its capital stock from $25,000 to $50,000.

Philadelphia, Pa.—An amendment of the certificate of incorporation of the International Light, Heat & Power Company of this city was lately filed, increasing the capital stock from $500,000 to $750,000.

Sandy Hill, N. J.—The United Gas, Electric Light & Fuel Company, of this place and Fort Edward, has filed with the Secretary of State a certificate of increase of capital stock from $150,000 to $200,000.

St. Louis, Mo.—A notice was recently filed by the Montana Water, Electric Power & Mining Company of its intention to extend its business to other States.

Power and Transmission.

Bozeman, Mont.—There is a rumor that when Nelson Story builds his new mills next spring he will also arrange to build a small electric plant for the purpose of furnishing power to business men in this city who use dynamos and want a steady power with which to run their machinery.

Automobiles.

Goshen, Ind.—A. E. Keith, who for the past two years has operated a stage service, is arranging for the purchase of an automobile which will seat 10 or 12 persons comfortably and cover the distance of 14 miles in 1 hour and 10 minutes.

LATEST QUOTATIONS OF ELECTRICAL SECURITIES.

Closing Prices—Monday, December 30, 1901.

STREET RAILWAY STOCKS.

NAME.	Par value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Bleeker Street and Fulton Ferry	100	33	36
Broadway and Seventh Avenue	100	248	249
Central Crosstown	100	255	260
Central Park, North and East River	100	208	220
Christopher and Tenth Street	100	180	190
Dry Dock, East Broadway and Battery	100	120	130
Eighth Avenue	100	400	410
Metropolitan Street Railway	100	161¼	161½
Ninth Avenue	100	196	205
Second Avenue	100	217	220
Sixth Avenue	100	175	215
Third Avenue	100	123	123½
Twenty-Third Street	100	408	415
OTHER CITIES.			
Albany United Traction	100	100	102
Brooklyn City Railway	100	242	243
Brooklyn Rapid Transit	100	64¾	64⅞
Baltimore United Railways, com	50	15⅜	15½
do. do. do. pref	50	91	92
Buffalo Railway	100	99	101
Cleveland City Railway	100	109	110
Cleveland Electric Railway	100	85¾	87½
Columbus (O.) Street Railway	100	43	49
Jersey City, Hoboken and Paterson	100	16	20
New Orleans City Railway, com	100	26	27
do. do. do. do. pref	100	102	106
North Jersey Street Railway	100	22½	24
Providence United Traction and Electric	100	109	110
Rochester (N. Y.) Railway, new	100	38	40
do. do. do. pref	100	94	96
St. Louis United Railways, com	100	31⅞	32
do. do. do. pref	100	89¾	60½
United Electric of New Jersey	100	280	281
PHILADELPHIA.			
American Railways	50	43¾	43
Citizens	50	359½	360
Columbus Railway	100	45	45½
Columbus Railway, pref	100	100	103
Consolidated Traction of New Jersey	100	67½	68½
Continental $29 paid	50	155	155½
Consolidated Traction of Pittsburg	50	23	23¼
do do pref	50	63	63¼
Dayton Traction	100	156	156¼
Fairmount Park and Haddington	50	71	71½
Fairmount Park Transportation	50	22	22½
Frankford & Southwark	50	466	466½
Germantown	50	147½	148
Green & Coates, $15 paid	50	151	151½
Hestonville Mantua & Fairmount	50	48	48½
do pref	50	72½	73
Indianapolis Street Railway	100	47	47½
Lehigh Avenue, $30 paid	50	42	42½
Newark, N. J.	100	..	..
Philadelphia City, $23.75 paid	50	205	205½
Philadelphia & Gray's Ferry, $25 paid	50	101	101½
Philadelphia Traction	50	97⅞	98
Railways Company General	5	2¼	2¼
Reading Traction	50	32¼	32½
Ridge Avenue, $28 paid	50	308½	310
Rochester	100	25	25½
Scranton and Carbondale	100	26¾	27
Second & Third	50	305½	306
Scranton Railway	50	24	24½
Thirteenth & Fifteenth	50	310	310½
Trenton Street Railway	50		
Union $30 5-6 paid	50	240	245
Union Traction, $17.50 paid	50	32¼	32¾
United Power and Transportation, $29 paid	25	40	40½
United Traction of Pittsburg	50	14	14½
do do pref	50	50	50½
United Traction of Reading, Pa	50		
West Philadelphia	50	252	252½
Wilmington and West Chester Traction	50	49	46½
BOSTON.			
Boston Elevated, full paid	100	166½	167
West End Street, com	50	93	93½
do. do. do. pref	50	111	112
CHICAGO.			
City Railway	100	187	188
Lake Street Elevated	100	11	11½
North Chicago	100	190	200
Union Traction, com	100	10½	10¾
do. do. pref	100	47½	48

STREET RAILWAY STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
PITTSBURG.			
Citizens' Traction Company	50	73	74
Consolidated Traction Company, com	50	23¼	23½
do. do. do. pref	50	63¾	63⅞
Federal Street and Pleasant Valley Railroad	25	..	57
Pittsburg and Birmingham Traction Co	50	47½	49
United Traction Company, pref	50	47	48

ELECTRIC LIGHT AND ELECTRIC MFG. COMPANIES' STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
NEW YORK CITY.			
Electric Boat, com	100	20	23
do do pref	100	41	43
Electric Lead Reduction	100	1¾	2
Edison Ore Milling Co	10	8	11
Electric Vehicle, com	100	2¾	3
do do pref	100	4	5
General Carriage	100	1¼	1½
General Electric	100	283⅜	283¾
BOSTON.			
Boston Electric Light	100	..	..
Edison Electric Illuminating	100	241	245
General Electric	100	283	283½
Massachusetts Electric Companies, com	100	32¾	33
" " " pref	100	92	92½
Westinghouse Electric & Mfg., com	50	87¾	87⅞
do do do pref	50	90	90½
CHICAGO.			
Chicago Edison	100	160	160½
National Carbon, com	100	19	19½
do do pref	100	83	83½
PHILADELPHIA.			
Electric Company of America	50	6	6½
Electric Storage Battery, com	100	61	63
do do do pref	100	61	63
General Electric Automobile	50	¼	⅜
National Electric	10	11	11½
Pennsylvania Electric Vehicle, com	50	1	1¼
do do do pref	50	1	1¼
Philadelphia Electric trust ctfs. $5 paid	25	4⅝	4⅞
OTHER CITIES.			
Allegheny (Pa.) Lighting Company	100	165	170
Buffalo General Electric Company	100	98	100
Hartford (Conn.) Electric Light	100	197	200
Narragansett Electric Company, Providence	50	92	93
London (Can.) Electric Company	100	104	107
Toronto (Can.) Electric Light	100	141	141¾

TELEPHONE AND TELEGRAPH STOCKS.

NAME.	Par Value.	Last Sale. Bid.	Last Sale. Asked.
BOSTON.			
American Telephone & Telegraph Company	100	164¾	165
Erie Telegraph & Telephone Company	100	17	17½
New England Telephone Company		133¾	134
NEW YORK.			
American Telegraph & Cable Company	100	91	94
Central & South American Telegraph Co	100	107	110
Commercial Cable Company	100	175	184
Franklin Telegraph Company	100	47	55
Erie Telegraph & Telephone Company	100		
Gold & Stock Telegraph Company	100	108	109
International Ocean Telegraph Company	100	120	123
Mexican Telephone Company	100	2	2½
New York & New Jersey Telephone Company	100	167	170
Pacific & Atlantic Telegraph	25	78	83
Postal Telegraph Cable Company	100		
Southern & Atlantic Telegraph Company	25	100	100
Commercial Union Telegraph Company	25	115	..
Western Union Telegraph Company		92⅞	92½
MISCELLANEOUS.			
American District Telegraph of Philadelphia	25	26	37
Bell Telephone Company of Canada	100	188	
Buffalo Bell Telephone Company	50	106	109
Cumberland Telephone & Telegraph Co	50	133½	133
Chesapeake & Potomac Telephone Company	100	72	75½
Chicago Telephone Company	100	200	210
Central Dist Prtg & Teleg Co of Pgh	100	148	150
Empire & Bay States Telegraph Company		78	84
Hudson River Telephone Company	100	100	105
Northwestern Telephone Company, guar	50	122	126
Providence (R. I.) Telephone Company	50	97½	98
Southern New England Telephone Company	100	.	.

ELECTRICAL SECURITIES.

Closing Prices, Monday, Dec. 30

INDUSTRIAL AND MISCELLANEOUS STOCKS.

	Par Value.	Last Sale. Bid	Last Sale. Asked.
Electro-Pneumatic Transit	10	1⅛	1⅝
Eddy Electric Manufacturing Company	25	8	8¼
Storey General Electric	10	9	12
Consolidated Car Heating	100	50	55
Standard Underground Cable	100	180	190
Pratt and Whitney, pref	100	84	92

STREET RAILWAY BONDS.

ALBANY.	Last Sale.	Int. Paid.
Albany Railway Company, cons. mtg. 5s	117½	J & J
do. do. do. gen. mtg. 5s	116½	M & N
Watervliet Turnpike & RR., 1st mtg. 6s	126	M & N
do. do. do. 2d. mtg. 6s	124	M & N
Troy City Railway Company, 1st 5s	115½	....
BROOKLYN		
Bkn. Heights, 1st mtg	108½	A & O
B., Q. C. & Sub., 1st mtg	117	J & J
do. 1st con mtg	101	M & N
Jamaica & Bkn 1st mtg	105	J & J
Sea Beach 1st mtg	86	M & S
Bkn. Un. El. 1st mtg	101	F & A
Nassau Electric, cn mtg	98	J & J
do. 1st mtg	114	A & O
Atlantic Avenue 1st mtg	108	A & O
do. do. gen mtg	115	A & O
NEW YORK		
Bleecker St & Fult'n Fer'y RR, 1st mtg 7s	98½	....
Cent P'k, N. & E R. RR, 1st cons mtg 4s	107	J & D
Central Crosstown RR, 1st mtg 6s	125	M & N
Coney Island & Brooklyn RR, 1st mtg 5s	101	J & J
D Dock, E Bd'y & Bat'y R gen mtg 5s	117	J & D
do. do. do. RR scrip 5 per cent.	102	F & A
Eighth Av RR Co, cert indebt 6 per cent	208	F & A
42d St, Man & St Nicholas Av 1st mtg 6s	116½	M & S
do. do. 2d mtg inc 6s	89	J & J
Lex Ave & Pav Ferry RR, 1st mtg g 5s	124	M & S
Metropolitan St Ry Co g mtg cl tr g 5s	120[illegible]	F & A
Second Ave Ry gen cons mtg 5s	120	M & N
do. deb 5s	108½	J & J
Steinway Ry (L. I.) 1st mtg g 6s	116	J & J
South Ferry RR Co 1st mtg 5s	110½	....
Third Ave RR 1st mtg g 5s	....	J & J
Twenty-third Street Ry 1st mtg 6s	......	J & J
do. deb 5s	106[illegible]	J & J
Union (Huckleberry) Ry 1st mtg 5s	113	F & A
BROOKLYN.		
Kings Co Elec L & P	200	Q & M
do. do. 1st	110	A & O
do. do. pur mtg	126	A & O
Edison consol mtg	99¾	J & J
PHILADELPHIA.		
Baltimore Traction 1st 5s coup 1929	....	M & N
do do col gold 5s 1900	100	J & J
Buffalo Railway con 5s reg coup 1931	118	F & A
Citizens of Ind 1st con gold 5s reg coup 1933	110	M & N
Columbus St Railway 1st con gold 5s coup 1932.	100	J & J
Continental Passenger 1st 6s coup 1909	....	J & J
Consolidated Traction of N. J. 1st gold 5s 1933.	109½	J & D
Crosstown (Col. O.) 1st gold 5s coup 1933	100½	J & D
Dayton (O.) Traction 1st gold 5s reg 1916	95	J & J
Duquesne Traction 1st 5s reg coup 1930	117¼	J & J
Electric-People's 4s trust ctfs reg 1945	96⅝	A & O
Fairmount Park Transp 1st gold 5s reg c 1912	....	M & S
do do 2d gold 5s reg coup 1912.	....	M & S
Germantown Passenger 1st 5s reg 1904	......	J & D
Hestonville 2d 6s coup 1902	102	M & S
do do con gold 5s reg coup 1924	120	M & N
Holmesburg, Tacony & Frank, 1st g 5s r c 1925.	100	M & N
Indianapolis St Railway gold 4s reg coup 1933	83	J & J
New York & Queens County 5s 1946	....	A & O
People's Pass stock trust certificates reg 1943	105¾	F & A
Philadelphia Traction col tr 4s coup 1917	106	F & A
Rapid Railway 1st g 5s reg coup 1915	105	M & S
Reading Traction 1st 6s reg coup 1933	128	J & J
Reading & Womelsdorf 1st 5s coup 1925	....	J & J
Rochester Railway con 5s reg coup 1930	110	A & O
Scranton & Carbondale 1st 6s reg coup 1923	100	J & J
Scranton Railway 1st con 5s reg coup 1932	105	J & J
Scranton Traction 1st 6s reg coup 1930	117	M & N
United Railways (Balto.) tr ctfs. 4s reg 1940	96	J & J
United Trac (Pitts.) gen mort 5s reg coup 1907.	115⅞	J & J
United Traction (Reading) 5s coup 1926	103	J & J
West Philadelphia mort 6s reg 1906	111	A & O
West Philadelphia 2d mort 5s coup 1926	118	M & N

NOTES FOR INVESTORS.

Latest quotations for copper are: Electrolytic, 12¾@12⅞c.; Lake, 13@13⅛c.; casting, 12⅜@12½c.

Estimates of the year's copper production of the Butte, Mont., mines, place the total at 251,000,000 pounds.

The Richmond and Petersburg (Va.) Electric Railway has issued $1,000,000 5 per cent. 30 year bonds for power houses and equipment.

The annual meeting of the stockholders of the Detroit United Railway Company will be held at the company's office in Detroit on January 21.

It is reported that Samuel Insull, president of the Chicago Edison Company, is backing the projected line from Chicago to Michigan City, Ind., to be built the coming summer.

A dividend of 1 per cent., has been declared on the stock of the Consolidated Traction Company of New Jersey, payable January 15. Books closed December 31 and reopen January 16.

New York friends of Manhattan Elevated declare that under the electrical operation of the system the economies to result will be equivalent to between 2 and 3 per cent. on the stock.

A New Haven, Conn., dispatch says that the Hartford Street Railway Company has sold $250,000 first mortgage 30-year bonds to a local firm on about a 3½ per cent. interest bearing basis.

The New York and New Jersey Telephone Company has declared the regular quarterly dividend of 1½ per cent. and an extra dividend of 1 per cent., both payable January 15 to stock of record January 4.

It is understood that Messrs. Kidder, Peabody & Co., have purchased $10,000,000 American Telephone & Telegraph 4 per cent. bonds which will probably be issued for public subscription after January 1.

The one cent an hour advance in the wages of its motormen and conductors, announced by the Union Traction Company, Philadelphia, to be operative as from January 1, 1902, amounts to $43.80 annually, or an aggregate of more than $300,000.

The "Record" says that the Rapid Transit franchises in Philadelphia have been transferred to the Union Traction interests. It is claimed that one of the conditions is that there shall be no tracks on Broad street and another condition provides for the financing of the Keystone Telephone Company.

The January disbursements on account of interest and dividends will be on an enormous scale. The payments at New York, it was estimated, will amount to $150,000,000; Boston $35,000,000; Philadelphia $25,000,000, and Cincinnati $4,000,000, a total for these four cities alone of $214,000,000.

A $3,000,000 mortgage on the Hudson River Electric Company to the Morton Trust Company of New York was recorded Saturday in Saratoga County (N. Y.) Clerk's office. It is a first mortgage to secure the issue of 3,000 5 per cent. coupon gold bonds of $1,000 each, covering real estate, franchises, etc.

General Electric directors have declared a semi-annual dividend of 3½ per cent. on the preferred stock, payable January 21 to stockholders of record January 15. Practically all of the preferred stock of the company has been exchanged for common, there being only 98 shares of the preferred outstanding and less than $500,000 of the debentures.

There was recently recorded in the Essex County Register's office in Newark, N. J., a deed of trust for $1,000,000 executed by the El Paso Electric Company to the State Trust Company of Boston, Mass. The deed covers underlying securities of various subsidiary companies, which operate all the electric lighting and power plants centering in El Paso, Tex. The State Trust Company is trustee of the mortgage holders.

Charles W. Morse says: "I am not in a position, that it would be appropriate for me to express an opinion on the reorganization plans of the Erie Telegraph & Telephone Company. It cannot be authoritatively stated that I have either disposed of my stock in that company, or have given an option on my stock. I will acknowledge, however, that I am now considering certain offers which involve my telephone interests."

The Continental Trust Company of Baltimore has been appointed trustee under the mortgage of the Philadelphia Company of Pittsburg to secure the issue of $22,000,000 consolidated mortgage and collateral trust 5 per cent. 50-year gold bonds, dated November 1, 1901. Of the total issue of bonds $6,500,000 will be reserved to take up bonds of the same amount now outstanding, $12,000,000 will be used to acquire the preferred shares of the Consolidated Traction Company of Pittsburg and $3,500,000 will be available for improvements, betterments and extensions. The bonds of the Philadelphia company will be delivered in Philadelphia to holders of certificates for stock of the Consolidated Traction Company by the Land Title & Trust Company of that city.

The operations of the Greene Consolidated Copper Company in Mexico are attracting the attention of mining men and capitalists all over the world. The late strikes made in the mines of the company are said to be of great extent and richness.. It has just been ascertained that a party of capitalists and experts left New York on December 27 for the purpose of inspecting the company's property and mines. With the party were Anson W. Burchard, consulting engineer of the General Electric Company; General Bissell, of Buffalo, N. Y.; Charles Adsit, chairman of the New York State Bankers' Association, of Hornellsville, N. Y.; M. M. Parker, H. A. Taylor, Assistant Secretary of the Treasury, and O. G. Staples, of Washington, D. C. These men represent special interests.

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